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A REVISION OF THE ICHNEUMON-FLIES OF THE GENUS CAMPOPLEGIDEA OCCURRING IN AMERICA NORTH OF MEXICO[1]

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INTRODUCTION

This paper consists of a systematic account of the species of *Campoplegidea* which inhabit America north of Mexico. Eighty species have been recognized of which thirty-seven are here described as new. Twenty-five names of previously described species are referred to the synonymy and one name is a nomen nudum. Two previously described species, apparently pertaining to *Campoplegidea*, have not been recognized, and one species, originally described as a *Campoplex*, is questionably referred to another genus. Previous authors have described or referred to species here placed in *Campoplegidea* under thirteen different generic and sub-generic names, five of which are now considered synonymous with *Campoplegidea*.

The material which forms the basis of this study is contained in the Canadian National Collection and the United States National Museum. The collections of the latter, in this genus, have been loaned to the writer through the kindness of the authorities of that institution. The above two collections contain the types of the majority of the species dealt with in this paper. Other important repositories of type material are the Academy of Natural Sciences at Philadelphia, the Peabody Museum of Yale University and the Quebec Public Museum. A few types are to be found in the collections of the Museum of Comparative Zoology at Cambridge, the University of Kansas and Massachusetts Agricultural College. The types of two species appear to be lost. The types of the new species described in this paper are deposited in the Canadian National Collection, the United States National Museum, and the Museum of Comparative Zoology.

In the prosecution of this study the writer has been materially assisted by several persons. To Mr. R. A. Cushman, specialist in Ichneumonidae at the United States National Museum, I am especially indebted. Through his instrumentality the loan of much valuable material has been arranged and he has contributed many helpful notes and criticisms during the progress of this work. For information concerning type material which I have been unable to see, I am indebted to Mr. W. F. Perkins of the British Museum of Natural History, Mr. E. T. Cresson Jr. of the Academy of Natural Sciences at Philadelphia, Dr. S. C. Ball of the Peabody Museum, Yale

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University, and Dr. Lorus J. Milne, formerly of Harvard University. My colleagues Mr. W. J. Brown and Dr. O. Peck have also assisted by comparing specimens and furnishing notes on certain types at Philadelphia. To Dr. Pierre G. Roy, Mr. Paul Rainville and Mr. Noel-M. Comeau of the Quebec Public Museum I am indebted for the many courtesies extended in connection with my visit to study the Provancher types in that Museum.

HISTORY AND CLASSIFICATION

The genus *Campoplegidea* was established by Mr. H. L. Viereck (Proc. U. S. N. M., XLII, 633, 1912) for those species of *Campoplex* Auct. nec Gravenhorst which agree generically with *Campoplex oxyacanthae* Boie (designated genotype by Viereck, op. cit.). As the genotype of *Campoplex* Gravenhorst, Viereck accepted *Campoplex difformis* Gmel., Grav. as designated by Westwood (1840). Viereck did not further define *Campoplegidea* but it was evidently his intention that it should consist of forms similar to many of those dealt with by Foerster, Holmgren and Schmiedeknecht under the genus *Campoplex*. In the same and subsequent publications Viereck established additional genera (*Anisitsia, Fiebrigia, Idiosomidea*, etc.) for certain American species which he segregated from *Campoplex* Auct.

In 1916 Viereck (Conn. St. Nat. Hist. Surv. Bull. 22, p. 268) relegated *Campoplegidea* and certain allied genera to subgeneric rank under *Casinaria* Holmg. Two years later (Proc. Biol. Soc. Wash., XXXI, 72, 1918) he proposed the subfamily *Charopsinae* (for *Charops* Holmg., etc.) and in 1925 (Trans. Roy. Soc. Can., XIX, Sec. V, p. 259) assigned to it *Campoplegidea* and a number of other genera, giving a table for their distinction and defining the subfamily briefly as follows: "propodeum at least extending to the end of the basal third of hind coxae; chitinous part of first sternite extending beyond the spiracle of the first tergite". The subfamily Campopleginae was defined by Viereck (Can. Ent., LVII, 176, 1925) thus: "propodeum at most usually not attaining end of basal third of hind coxae, if extending to or beyond the basal third of hind coxae then with the chitinous part of first sternite not extending beyond the spiracles of first tergite".

In the opinion of the writer the recognition of two subfamilies for the two groups of genera segregated by Viereck is unwarranted. The characters selected by Viereck to distinguish the subfamilies have not proven entirely satisfactory and it is held that the uniting of all the genera into one group (the tribe *Campoplegini*) is a more natural and convenient arrangement, and more in harmony with the prevailing classification of the family.

HOST RELATIONS

Although adults of a number of species are rather common, comparatively few specimens have been reared. Members of the genus are solitary, internal parasites of lepidopterous larvae, and the records of our species are confined to moths, particularly those of the families Geometridae and Noctuidae and to a lesser extent the Notodontidae, Lasiocampidae and Tortricidae. It may be noted that the majority of the hosts are forms which feed on the foliage of our common coniferous and deciduous trees. Among the European species a much greater diversity of hosts has been reported but some of these records may require verification before they can be accepted.

Genus CAMPOPLEGIDEA Viereck

Campoplegidea Viereck, Proc. U. S. N. M., XLII, 633, 1912. (Genotype *Campoplex oxyacanthae* Boie.)

Anisitsia Viereck, Proc. U. S. N. M. XLII, 632, 1912. (Genotype *Campoplex villosus* Nort.)

Fiebrigia Viereck, Proc. U. S. N. M., XLII, 638, 1912. (Genotype *Campoplex texanus* Ashm.)

Pseudocasinaria Viereck, Proc. U. S. N. M., XLII, 644, 1912. (Genotype *Casinaria americana* Ashm.)

Viereckiana Strand (n.n. for *Anisitsia* Vier. nec. Eigenmann), Arch. f. Naturg., 80, A I, p. 163, 1914.

Idiosomidea Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 271, 1925. (Genotype *Campoplex bellulus* D.T.) (= *photomorpha* Vier.)

The genera synonymized above in some cases represent groups of species within the genus, but in the opinion of the writer the characters defining these groups are not sufficiently distinct to warrant the retention of these names even in a subgeneric sense. Moreover, their employment would logically call for the erection of additional genera for other groups of species, and there would still remain a number of rather diverse species which could not be conveniently classified. The most satisfactory procedure appears to be to consider the entire group as one large genus which may be described as follows.

Description of Genus

Length 6–18 mm.; antennae a little shorter than body.

Head transverse, never greatly thickened antero-posteriorly; temples usually distinctly receding, more or less convex, sometimes not or only very slightly receding; face flat or weakly convex, sometimes slightly elevated at middle, *clypeus in same plane as face and basally not delimited from it, broad, free margin truncate or very broadly arcuate;* face and clypeus densely punctate, with fine vestiture which is sometimes more or less parted in two vertical rows; front flat or concave, frequently with a fine, median, vertical carina; *eyes large, distinctly emarginate opposite antennae;* mandibles large, distinctly bidentate, upper tooth slightly larger than lower; lower margin of mandible often produced as a slight flange, occasionally strongly produced; palpi slender, none of segments greatly modified; antennae filiform, slightly thickened toward middle of flagellum, scape obliquely truncate; ocelli of moderate size; ocellocular space varying from one-third to approximately one and one-third times diameter of lateral ocellus; malar space varying from one-fourth to two-thirds basal width of mandible.

Thorax moderately broad; notauli absent or only briefly and feebly defined anteriorly; sternauli absent; prepectoral carina distinct; scutellum convex, more rarely flattened or impressed, apex moderately broad to narrow, sides of disk more or less margined by carinae; *apex of propodeum always prolonged posteriorly, extending to or beyond the basal one-third of dorsal surface of hind coxae but never extending to their apices; propodeum dorsally with a more or less strongly defined median longitudinal sulcus*, rarely with sulcus very poorly defined or absent; *propodeal carinae incomplete, basal transverse carina usually present but rather short with lateral portions poorly defined; apical transverse carina always incomplete at middle with lateral*

portions usually distinct, sometimes extending obliquely forward for some distance on either side of the longitudinal sulcus; propodeum occasionally with portions of longitudinal carinae present; *propodeal spiracles linear or elongate-oval.*

Wings large; stigma and radial cell narrow; *areolet distinct*, trapezoidal; second intercubitus frequently curved; discocubitus curved; second recurrent varying from almost straight to distinctly curved in region of bulla; second and third abscissae of discoideus about equal, or rarely second much shorter than third; nervulus post-furcal; nervellus broken below middle.

First abdominal segment narrowly petiolate, its apical one-third expanded to form a post-petiole in the anterior portion of which lie the spiracles, petiole with or without a fovea or impression on either side before spiracle; sclerotized portion of sternite always terminating posteriorly distinctly before apex of tergite, membranous portion (plica) extending below second tergite; *second abdominal segment more or less laterally compressed, the following segments strongly so;* spiracle of second tergite at or beyond middle of lateral margin; lateral margins of third tergite sometimes more or less narrowly inflexed; ovipositor laterally compressed, straight or slightly decurved, with a distinct dorsal sub-apical notch; *sheath short, usually shorter than depth of abdomen at apex, rarely almost as long as first abdominal segment.*

In colour the majority of species have the head and thorax black with the abdomen largely or entirely reddish. When black is present on the abdomen it is usually confined to the basal and apical segments; rarely the abdomen is entirely black. Some species have the thorax more or less ornamented with reddish and in a few instances it is largely or entirely reddish; in one species the head is also reddish. The legs vary from largely reddish to black, or a combination of these two colours; frequently the hind tibia and apical portions of anterior legs are more or less yellow. The wings vary from clear hyaline to pale dusky, with the apices sometimes a little darker. Antigeny in colour of tegulae and legs occurs in some species, the males having the legs more highly ornamented with yellow than their females.

In the foregoing description the italicized characters are of special value in defining the genus and particular attention should be given them in distinguishing between *Campoplegidea* and allied genera.

Discussion of Certain Other Campoplegine Genera

For several reasons it is not possible to present a satisfactory table for the distinction of all the North American genera of *Campoplegini*. It has been thought of value, however, to discuss briefly, a number of genera which for one reason or another might be confused with *Campoplegidea*. The genera dealt with below agree with *Campoplegidea* in having the apex of the propodeum produced posteriorly distinctly (at least to the basal one-third) beyond the base of the hind coxae. A number of genera in which the apex of the propodeum extends very slightly beyond the base of the hind coxae are not considered, since they may be readily separated from *Campoplegidea* by differences in the form of eyes, form and areolation of propodeum, shape of propodeal spiracles, form of abdomen and wing venation.

Casinaria Holmg., as represented by a number of American species including *genuina* (Nort.), *orgyiae* (How.), *eupitheciae* Vier. and *infesta* (Cress.), is undoubtedly closely related to *Campoplegidea*. It differs in having the propodeal spiracles broadly oval, the abdomen less distinctly laterally compressed; also the head is lenticular in shape and the clypeus is narrower and frequently slightly convex. It may be remarked that the more or less strongly lenticular head is characteristic of a number of genera in this group, notably *Zastenomorpha* Vier., *Charopsimorpha* Vier., *Zacharops* Vier. and *Charops* Holmg., the last mentioned genus (not known from North America) agreeing with *Campoplegidea* in having the propodeal spiracles elongate, but differing in the absence of an areolet and in having a pair of processes on the mesosternum between the middle coxae.

Zastenomorpha Vier. is also very closely allied to *Campoplegidea* but apparently worthy of generic separation. The strongly lenticular head, very elongate propodeum (the posterior extremity of which attains the apex of hind coxae) and the small, oval, propodeal spiracles are sufficiently characteristic to distinguish it.

In *Charopsimorpha* the propodeal spiracles are small and almost circular, the propodeum is short and lacks a median sulcus, the clypeus is slightly elevated with its anterior margin very narrowly impressed, and the areolet is absent.

Zacharops resembles *Charops* but lacks mesosternal processes. The propodeal spiracles are small and oval and the propodeum is without a median sulcus. The scutellum is depressed and concave between the lateral carinae and the areolet is absent. In *Z. annulipes* (Ashm.), the genotype, the propodeal areas are complete and the petiole is long and very slender.

In the form of head, thorax, propodeum and first abdominal segment, *Nothanomaloides* Vier. agrees with *Campoplegidea*. It differs in having small, circular, propodeal spiracles, and in the female, by the stout, strongly flattened, upcurved ovipositor. The outer posterior angle of the second discoidal cell is more strongly acute than in *Campoplegidea*.

Idechthis Foer. is probably not generically distinct from *Campoplex* Grav. Because of the oval propodeal spiracles and the rather strongly produced apex of the propodeum it bears a resemblance to *Campoplegidea* but may be readily distinguished by the scarcely emarginate eyes, more complete propodeal areolation and less strongly compressed abdomen.

Nemeritis Holmg. has the propodeum produced, but areolate, and with small, circular spiracles. Allied to *Nemeritis* is *Phaedroctomus* which, however, has the propodeum less strongly produced posteriorly, and the wings without an areolet.

Campoctonus Vier. superficially resembles *Campoplegidea* but may be distinguished from it by the much narrower and slightly convex clypeus, convex propodeum which has the areola more or less defined but open posteriorly, decurved petiolar segment and the strongly compressed upcurved ovipositor.

Except for its posteriorly produced propodeum *Pseuderipternoides* Vier. has little in common with *Campoplegidea*. It differs particularly in having circular propodeal spiracles and a completely areolate convex propodeum, also the abdomen is not compressed and the ovipositor is distinctly longer.

Groups in the Genus

In this paper the species are arranged, where possible, in what appear to be natural groups, and in the key emphasis has been placed on the structural characters distinguishing these groups. Not all the groups are equally well defined, some are susceptible to subdivision, and some, through more or less intermediate species, merge with other groups.

Most groups are best defined by a combination of several characters. The absence of a character is not to be accepted as grounds for excluding a species from a given group, provided that, in general, it agrees with other group characters. For example, *vara*, of the *diversa* group, lacks petiolar foveae; also the last three species of the same group do not have the lateral margins of the third tergite inflexed. In other respects these species agree with the characters defining the group.

It may be noted that the above character (lateral margins of third tergite inflexed) while of considerable value as a "key character", is of less significance in a natural arrangement of species. Its more or less sporadic occurrence in such dissimilar groups in the genus as the *diversa*, *nigerrima*, *egregia* and *rufescens* groups strengthens this opinion.

On the other hand the nature of the petiolar fovea appears to be of considerable significance in a natural arrangement of species. Species range from a condition in which the foveae are well defined and close to the spiracles, through forms with small or indistinct foveae, to others in which the foveae are entirely absent. In the *diversa* group, with one exception, the foveae are well defined. Those members of the *subtilis* group, (e.g., *glauca* and *caliginosa*) which have foveae resembling those found in the *diversa* group, tend to approach in other respects the characters of the *diversa* group. Conversely, groups entirely without foveae are otherwise usually less similar to the *diversa* group, and in no case, among the groups most dissimilar, is there any trace of a fovea present.

Certain groups in the genus seem related to each other in a more or less direct line of development. Omitting the *kukakensis* group, the status of which is uncertain, the *diversa* group appears to have affinities with the *subtilis* group, possibly through such species as *glauca* and *caliginosa*. At the other extreme of the *subtilis* group, such forms as *fossata* and *woodi* point the way to the *gracilis* group, which in turn, through *interstitialis*, leads to species like *arizonensis* of the *texana* group.

A number of small groups of species are dealt with following the *diversa* group, since their affinities appear to lie with this group and with the *subtilis* group. Of these, the *minor* group is probably best placed

near the *subtilis* group, having as it does, several features in common with *subtilis*. The five species comprising the *montrealensis* group form a rather compact group, easily recognized by the character of the mandibular lamina. The *variabilis* group, characterized by the excavate genae, is perhaps not a natural one, *variabilis* possibly being allied with the *montrealensis* group, and *varicoxa* being more like species of the *minor* and *subtilis* groups. The *laticincta* group, while rather distinctive, may be allied to the *montrealensis* group. *Pectoralis* is a group of uncertain position, possibly allied to *variabilis* or *laticincta*, but also possessing characters (large broad areolet, and recurved basal propodeal carina) suggestive of the last few groups in the genus.

The *texana* group is one of the largest and best defined groups in the genus. Its most natural position appears to be following the *gracilis* group. The affinities of the *tumida* and *ocellata* groups are not understood, but the two groups, having some features in common, are perhaps naturally allied.

In the *egregia*, *rufescens* and *nigerrima* groups the lateral margins of the third tergite are sharply inflexed. Apart from this character these groups differ markedly among themselves, and also from the *diversa* group, which is the only other group in the genus having the third tergite so formed. The *nigerrima* group, while very distinctive, has some features (the large broad areolet, and recurved basal propodeal carina) which ally it with the *villosa* and *robusta* groups. *Rufescens*, because of its conspicuously pilose scutellum and the reddish thorax and propodeum, may be related to some of the groups which follow. *Egregia* is a very distinctive group, apparently highly specialized, and not closely allied to any other group in the genus.

The remaining groups treated all have the lateral margins of the third tergite not inflexed. The *pallescens* group is unusual both in structure and colour and apparently is not closely allied to any of the groups which follow. The *villosa* group is rather intermediate between the *nigerrima* and *robusta* groups. The *brachiator* group is not closely allied to any other, but is perhaps best placed near the *johnsoni* group, which latter may constitute a link between the *robusta* group and the last group consisting of *vitticollis* and *pilosa*. The *vitticollis* group is remarkable in several respects, notably the compressed post-petiole, evenly parted facial pile, and the extraordinarily dense propodeal vestiture in the male.

A list of species follows on next page.

LIST OF SPECIES

In the following list the species are arranged by groups, in the order treated in the text; the species bearing the group name is preceded by an asterisk; synonyms are italicized.

Group I
* 1. kukakensis (Ashm.)

Group II
2. vara n. sp.
3. canadensis n. sp.
4. signata Vier.
* 5. diversa (Nort.)
wyomingensis (Vier.)
walleyi Vier.
6. diversella n. sp.
7. downesi Vier.
vadosa Vier.
8. planatella Vier.
9. confluens n. sp.
10. associata n. sp.
11. argentea (Nort.)
citriscapa Vier.
12. planata Vier.
13. semirufa (Prov.)
okanaganensis Vier.
14. vibercifera Vier.
15. egregiata Vier.
16. stricklandi Vier.

Group III
*17. montrealensis Vier.
18. assita (Nort.)
curvata Vier.
citripes Vier.
19. nigritibialis Vier.
20. laminata n. sp.
21. insolita n. sp.

Group IV
*22. variabilis (Frankl.)
23. varicoxa Vier.
reticulata (Vier.)
paenealia (Vier.)

Group V
*24. laticincta (Cress.)
nigripes (Prov.)
brooksi Vier.
25. caudata n. sp.

Group VI
*26. pectoralis n. sp.

Group VII
*27. minor (Prov.)
decorata (Vier.)
28. mitis n. sp.
29. pacifica (Vier.)
30. maritima n. sp.

Group VIII
*31. subtilis Vier.
32. crassicornis (Prov.)
mimetica Vier.
crassata Vier.
sessilis Vier.
flavicoxa Vier.
33. glauca (Nort.)
rossi Vier.
34. caliginosa n. sp.
35. diversicolor Vier.
36. vicina (Prov.)
relectum (Davis)
37. seamansi Vier.
edmontonensis (Vier.)

Group VIII—*Concluded*
38. bicoloripes (Vier.)
39. rotunda n. sp.
40. occidentalis (Davis)
41. grahami n. sp.
42. fossata (Vier.)
43. woodi Vier.
erythrosoma Vier.
44. americana (Ashm.)
erythromera Vier.

Group IX
*45. gracilis n. sp.
46. townsendi n. sp.
47. interstitialis n. sp.
48. experta (Cress.)
49. rufigaster n. sp.

Group X
*50. texana (Ashm.)
51. scalaris (Prov.)
52. simulans n. sp.
53. arizonensis n. sp.
54. flavescens n. sp.
55. turmalis n. sp.
56. bellula (D. T.)
photomorpha (Vier.)
secunda (Vier.)
57. nitida n. sp.
58. lobata n. sp.
59. deceptor n. sp.
60. australis n. sp.

Group XI
*61. tumida n. sp.
62. pulchella n. sp.

Group XII
*63. ocellata n. sp.

Group XIII
*64. egregia (Vier.)

Group XIV
*65. rufescens n. sp.

Group XV
*66. nigerrima (Vier.)
67. luctuosa (Prov.)

Group XVI
*68. pallescens n. sp.

Group XVII
*69. villosa (Nort.)

Group XVIII
*70. robusta n. sp.
71. conformis n. sp.
72. major (Cress.)
totalis Vier.
73. magnifica n. sp.

Group XIX
*74. brachiator (Say)
xanthogaster (Brullé)

Group XX
*75. johnsoni n. sp.
76. fuscitarsis Vier.
77. ellopiae Wly.
78. quebecensis n. sp.

Group XXI
*79. vitticollis (Nort.)
80. pilosa n. sp.

KEY TO SPECIES IN AMERICA NORTH OF MEXICO

1. Abdomen entirely black; petiolar segment slightly decurved in lateral aspect; length 8 mm. ..... *kukakensis* (Ashm.)

   Abdomen conspicuously reddish or when rarely entirely black (only in *canadensis*, *luctuosa* and *nigerrima*) then petiolar segment not decurved and length of body not less than 12 mm. 2

2. Lateral margins (epipleura) of third tergite in basal half, or more, sharply inflexed or folded under; petiole (except in *vara*) with a large, deep fovea on either side before spiracle, distance from deepest part of fovea to spiracle often less and never much greater than distance between two spiracles measured across post-petiole; propodeum short, stout, apex rarely extending much beyond basal third and never beyond middle of dorsal surface of hind coxae; apical transverse carina of propodeum usually well defined laterally and often extending far forward on either side of longitudinal sulcus to almost attain lateral portions of basal transverse carina; scutellum large, broad; second abdominal tergite short, spiracle usually located at or only slightly beyond middle; ventral plica of first segment scarcely longer than that of second. . . . 3

   Lateral margins of third tergite not inflexed (except in *diversicolor* and *semirufa* at extreme base) or when rarely largely inflexed then petiolar fovea absent and otherwise not agreeing with above characters. 13

3. Petiole with a well defined fovea on either side a short distance before spiracle. 4

   Petiole without a fovea but rather with a more or less distinct shallow groove on either side extending far in front of spiracle. ..... 2. *vara* n. sp.

4. Abdominal tergites entirely black; temples only slightly receding for some distance behind eyes; post-petiole very broad, viewed in lateral aspect strongly elevated above petiole. ..... 3. *canadensis* n. sp.

   Abdominal tergites always conspicuously more or less reddish; temples distinctly, sometimes strongly receding; post-petiole only moderately broad and not strongly elevated above petiole. 5

5. Scutellum almost flat, posterior portion sloping, broad and low, in profile the apex even with post-scutellum; propodeum posteriorly with a short stub of a median longitudinal carina; hind femora usually reddish or rufopiceous; length 13 mm. ..... 4. *signata* Vier.

   Scutellum convex, often strongly so, in profile the apex elevated distinctly above level of post-scutellum; propodeum rarely with a stub of a median carina; hind femora black except in species having a length not exceeding 9 mm. 6

6. Mesopleura rather coarsely punctate, the intervals between punctures not distinctly sculptured; speculum polished; scape with a yellow spot below; temples broadly rounded, moderately receding; length 11.5 mm. ..... 6. *diversella* n. sp.

   Mesopleura more finely punctate, the intervals between punctures with distinct, fine sculpture; speculum without an extensive polished area; scape rarely with a yellow spot below; temples strongly receding except in species having a length not exceeding 9 mm. 7

7. Length 9 mm.; temples only moderately receding; hind femora dark reddish-brown. ..... 10. *associata* n. sp.

   Length not less than 12 mm.; temples strongly receding; hind femora black or piceous. . . 8

8. Propodeum without a distinct, median, longitudinal sulcus. ..... 8. *planatella* Vier.

   Propodeum with a distinct, median, longitudinal sulcus. 9

9. Mesopleura with a conspicuous band of crowded, confluent punctures, extending from prepectoral carina to fovea. ..... 9. *confluens* n. sp.

   Mesopleura without such a band of punctures. 10

10. Longitudinal sulcus of propodeum dull and transversely rugulose throughout; junction of occipital and hypostomal carinae distant from base of mandible two-thirds basal width of latter; speculum entirely finely sculptured and only feebly shining; apex of abdomen without blackish markings. 11

    Longitudinal sulcus of propodeum mostly smooth and shining along deepest portion of basal half; junction of occipital and hypostomal carinae distant from base of mandible one-third to one-half basal width of latter; speculum usually with a small unsculptured area; apex of abdomen often marked with blackish. 12

11. Scape and pedicel yellow, sometimes with a brownish stripe above; rim-like margin of antennal foramen rather strongly elevated outwardly above, inwardly above and between antennae breaking down into two or three short carinae; hind tibia narrowly blackish at apex ..... 11. *argentea* (Nort.)

Scape and pedicel entirely dark brown or black; rim-like margin of antennal foramen strong and entire; hind tibia broadly blackish at apex ..... 12. *planata* Vier.

12. Apical three or four tergites largely or entirely black; hind tibia brownish-black with a narrow, usually incomplete, obscure, sordid yellowish band or stripe posteriorly on basal half ..... 7. *downesi* Vier.

Abdomen reddish except at base; hind tibia conspicuously broadly banded with yellow, the band extending beyond middle of tibia ..... 5. *diversa* (Nort.)

13. Length 13–17 mm.; petiolar fovea large and rather close to spiracle; lateral margins of third tergite not inflexed or if so only at extreme base *(semirufa)*; in other respects agreeing with characters in first alternative of couplet 2 14

Size varying but petiolar fovea present only in a few species having length not exceeding 11 mm. (when present fovea usually smaller and frequently much further in front of spiracle than distance between the two spiracles); apex of propodeum usually extending distinctly beyond basal third of dorsal surface of hind coxae; second abdominal tergite frequently elongate with spiracle usually distinctly beyond middle; plica of first segment usually much longer than that of second 17

14. Junction of occipital and hypostomal carinae distant from base of mandible three-fourths basal width of latter; upper margin of antennal foramen produced, with three or four short rugae radiating from it ..... 13. *semirufa* (Prov.)

Occipital and hypostomal carinae not uniting before base of mandible; upper margin of antennal foramen not produced, without conspicuous rugae 15

15. Second tergite with spiracle at apical two-fifths; areolet sessile; abdomen black beyond apex of fourth tergite ..... 16. *stricklandi* Vier.

Second tergite with spiracle only slightly beyond middle; areolet petiolate; fifth and sixth tergites conspicuously reddish 16

16. Tegulae pale yellow; maxillary palpi stout, fourth segment distinctly shorter than third ..... 14. *vibecifera* Vier.

Tegulae dark brown; maxillary palpi long and slender, fourth segment fully as long as third ..... 15. *egregiata* Vier.

17. Lower margin of mandible with a broad flange or lamina which projects strongly forward and terminates distally in a sharp curve or an abrupt truncation 18

Lower margin of mandible without such a lamina, sometimes with a less conspicuous, downward projecting flange which terminates distally in a long gradual curve 22

18. Occipital carina strongly, flaringly produced in region of genae, before base of mandible 19

Occipital carina only slightly elevated in genal region 20

19. Mandibular lamina with free margin curving strongly distally; face, including clypeus, not distinctly longer than broad; male with middle coxae largely black ..... 17. *montrealensis* Vier.

Mandibular lamina with free margin abruptly truncate distally; face, including clypeus, much longer than broad; male with middle coxae largely yellow ..... 18. *assita* (Nort.)

20. Face, including clypeus, as broad as long; tegulae and hind tibiae black (B.C., Wash., Calif.) ..... 19. *nigritibialis* Vier.

Face, including clypeus, slightly longer than broad; tegulae yellow or brown; hind tibia more or less marked with yellow toward base (N. E. America) 21

21. Tegulae yellow; middle tibia entirely yellow ..... 20. *laminata* n. sp.

Tegulae brown; middle tibia with a brown or blackish stripe on inner surface. ..... 21. *insolita* n. sp.

22. Genae with a small but deep impression or cavity flanking the hypostomal and occipital carinae just before base of mandible, the carinae strongly elevated in this region ... 23

Genae without such a cavity 24

23. Propodeum rather evenly transversely rugulose medially; tegulae of female black; length 9–10.5 mm. ..... 22. *variabilis* (Frankl.)
Propodeum irregularly rugulose medially; tegulae of female yellow; length 7–8 mm. ..... 23. *varicoxa* Vier.

24. Head rather thick antero-posteriorly; temples strongly rounded and only slightly receding; sides and dorsal surface of propodeum meeting at a rather sharp angle; body with conspicuous, long, pale vestiture; abdomen contrastingly red and black, the basal two, and apical three or four segments black; sheath either three-fourths as long as first segment of abdomen, or propodeum without a median longitudinal sulcus; length 11–13 mm. 25
Not agreeing entirely with above combination of characters 26

25. Sheath of ovipositor less than one-half as long as first abdominal segment; propodeum without a distinct, median, longitudinal sulcus ..... 24. *laticincta* (Cress.)
Sheath of ovipositor three-fourths as long as first abdominal segment; propodeum with a distinct, median, longitudinal sulcus ..... 25. *caudata* n. sp.

26. Lateral portions of prepectoral carina obsolete, the well defined median portion continuous with the strongly elevated margin of coxal scrobe; petiole with a shallow, elongate groove on either side before spiracle; propodeum narrow, median longitudinal sulcus very shallow, basal transverse carina distinct, its apices well defined and curving forward in direction of spiracle; junction of occipital and hypostomal carinae distant from base of mandible almost one-half basal width of latter; temples strongly receding; mesopleura rather coarsely punctate, without sculpture between punctures; areolet large, rather broad; abdomen reddish except at base. ..... 26. *pectoralis* n. sp.
Lateral portions of prepectoral carina usually well defined above level of coxal scrobe, the latter often without a distinctly elevated margin; otherwise not entirely as above 27

27. Abdomen strongly compressed, post-petiole not or only very slightly depressed; gena never with a rounded prominence situated on a level with lower extremity of eye 28
Abdomen only moderately compressed, post-petiole distinctly depressed, or if not with these characters then gena with a conspicuous rounded prominence situated on level with lower extremity of eye 63

28. Lateral margins of third tergite not inflexed, except rarely at extreme base *(diversicolor)*. 29
Lateral margins of third tergite sharply inflexed, except sometimes at extreme apices 65

29. Lateral faces of scutellum sparsely, inconspicuously hairy; thorax and propodeum uniformly black; areolet usually rather small and narrow, never very broad, intercubiti always forming an acute angle; petiole sometimes with a fovea or groove on either side before spiracle; lateral surfaces of post-petiole not distinctly flattened and not strongly shagreened 30
Lateral faces of scutellum densely, conspicuously hairy, or if not then thorax and propodeum prominently marked with reddish or body entirely pale; areolet usually large and broad, intercubiti often forming a right or obtuse angle; petiole never with a fovea or groove on either side before spiracle; lateral surfaces of post-petiole sometimes distinctly flattened and strongly shagreened 68

30. Scutellum evenly convex or rarely somewhat flattened; first abdominal segment not upcurved; propodeal sulcus usually distinct and rather broad; apex of propodeum never strongly neck-like; post-petiole broader than petiole, the latter sometimes with a fovea on either side before spiracle; size variable 31
Scutellum, at least apically, distinctly flattened or impressed; first abdominal segment slightly upcurved; propodeum either with a broad, very shallow, transversely costate, longitudinal sulcus, in which case the apex of propodeum is produced posteriorly to apical three-fourths of coxae as a slender neck-like projection, or with a narrow, rather sharply impressed sulcus; post-petiole usually only slightly broader than petiole, the latter without a fovea on either side before spiracle; small or medium sized species 53

31. Humeral angles of pronotum prominently projecting laterally in front of tegulae; propodeal spiracles small, often short-oval; length not exceeding 7.5 mm. 32
Humeral angles of pronotum not prominently projecting laterally in front of tegulae; propodeal spiracles usually more elongate; length usually exceeding 7.5 mm. 35

32. Hind femora reddish 33
Hind femora blackish 34

33. Tegulae pale yellow; apex of abdomen uniformly reddish or rarely with the crest of apical tergites more or less blackish ..... 27. *minor* (Prov.)
Tegulae dark brown; apex of abdomen broadly black ..... 28. *mitis* n. sp.

34. Apex of abdomen broadly black (Western N. A.) ..... 29. *pacifica* (Vier.)
Apex of abdomen reddish (Eastern N. A.) ..... 30. *maritima* n. sp.

35. Mesopleura in greater part opaque or only very feebly shining, always with distinct microsculpture between punctures; propodeum with a rather broad, median, longitudinal sulcus; disk of scutellum usually margined laterally by carinae except near apex; petiole with a more or less distinct fovea or shallow impression on either side before spiracle; petiole black except sometimes in species *(glauca)* with a distinct fovea 36
Mesopleura coarsely punctate, in greater part polished between punctures (in doubtful cases the petiole uniformly reddish); disk of scutellum with or without lateral carinae; petiole polished, cylindrical, without trace of lateral fovea or impression 49

36. Malar space almost two-thirds as long as basal width of mandible; ocellocular space slightly greater than diameter of lateral ocellus; tegulae and hind femora black; second abdominal tergite short ..... 31. *subtilis* Vier.
Malar space rarely as long as one-half basal width of mandible; ocellocular space rarely equal to diameter of lateral ocellus 37

37. Disk of scutellum weakly convex and margined laterally almost to apex by very strongly elevated carinae; abdomen narrowly blackish at apex (length 7–8 mm.) ..... 32. *crassicornis* (Prov.)
Disk of scutellum usually more strongly convex and much less strongly margined laterally by carinae 38

38. Temples strongly receding immediately behind eyes; junction of occipital and hypostomal carinae distant from base of mandible one-half to three-fourths basal width of latter; propodeum rather short, apical carina extending far forward on either side median sulcus to almost attain lateral portions of basal carina; petiole with a distinct fovea on either side rather close to spiracle 39
Not entirely agreeing with above combination of characters 40

39. Abdomen uniformly reddish at apex; hind femora and usually more or less of petiole and post-petiole reddish or rufo-piceous (Eastern N. A.) ..... 33. *glauca* (Nort.)
Apical three or four abdominal segments black; hind femora, petiole and post-petiole black (Alta., B.C., Ore.) ..... 34. *caliginosa* n. sp.

40. Extreme base of lateral margin of third tergite inflexed; lateral carina of mesoscutum terminating posteriorly opposite basal lateral angles of scutellum in a conspicuous, rounded lobe; occipital and hypostomal carinae not uniting before base of mandible. ..... 35. *diversicolor* Vier.
Lateral margin of third tergite not inflexed at extreme base; lateral carina of mesoscutum not terminating in such a lobe 41

41. Scutellum short and very broad, the apex broad and sloping; mesoscutal carina unusually high opposite ends of scutellar groove; temples distinctly receding; occipital and hypostomal carinae not uniting before base of mandible; hind femora black; apical tergites of abdomen not conspicuously blackish ..... 36. *vicina* (Prov.)
Scutellum of normal width, the apex narrow and less sloping; mesoscutal carina not unusually high; otherwise not entirely as above 42

42. Hind femora blackish 43
Hind femora conspicuously reddish 46

43. Temples scarcely receding for some distance behind eyes, then strongly rounded to occiput; occipital and hypostomal carinae not uniting before base of mandible; basal transverse carina of propodeum distinct 44
Temples evenly, moderately receding; occipital and hypostomal carinae uniting a short distance before base of mandible; basal transverse carina very weak 45

44. Apical abdominal tergites conspicuously blackish; dorsal and lateral surfaces of propodeum meeting at a rather abrupt angle ..... 37. *seamansi* Vier.
Apical abdominal tergites uniformly reddish; dorsal and lateral surfaces of propodeum more roundly united ..... 38. *bicoloripes* (Vier.)

45. Abdomen uniformly reddish at apex; front femora more or less blackish at base; propodeum rather broad (N. S.) ..... 39. *rotunda* n. sp.
Abdomen conspicuously blackish at apex; front femora uniformly reddish; propodeum more elongate (B. C.) ..... 40. *occidentalis* (Davis)

46. Malar space one-half as long as basal width of mandible; stigma pale brownish; temples weakly receding ..... 42. *fossata* (Vier.)
Malar space not more than one-third basal width of mandible; stigma dark brown or black; temples moderately to rather strongly receding 47

47. Abdomen conspicuously blackish at apex 48
Abdomen uniformly reddish at apex ..... 43. *woodi* Vier.

48. Tegulae black; hind tibia uniformly reddish ..... 41. *grahami* n. sp.
Tegulae tawny or yellow; hind tibia more or less blackish at apex ..... 44. *americana* (Ashm.)

49. Petiole black, post-petiole more or less reddish at apex 50
Petiole and post-petiole uniformly reddish 52

50. Hind femora reddish ..... 45. *gracilis* n. sp.
Hind femora black 51

51. Front with a short, strongly elevated, tubercle-like, vertical carina below median ocellus ..... 46. *townsendi* n. sp.
Frontal carina feebly defined, not at all tubercle-like ..... 47. *interstitialis* n. sp.

52. Malar space one-third to one-fourth basal width of mandible; ocellocular space a little less than diameter of lateral ocellus; areolet of moderate size and width ..... 48. *experta* (Cress.)
Malar space almost one-half basal width of mandible; ocellocular space equal to diameter of lateral ocellus; areolet small and narrow ..... 49. *rufigaster* n. sp.

53. Petiole without a trace of dorso-lateral carinae, cylindrical or nearly so in cross-section 54
Petiole with more or less distinct dorso-lateral carinae 61

54. Propodeum with a broad, shallow, median, longitudinal, transversely costate sulcus; propodeal spiracles short-oval; lateral longitudinal carinae of propodeum distinct 55
Propodeum with a narrow, median, longitudinal sulcus; propodeal spiracles usually elongate-oval; lateral longitudinal carina of propodeum absent 56

55. Scape yellowish below; apex of abdomen not marked with blackish ..... 50. *texana* (Ashm.)
Scape blackish below; apex of abdomen marked with blackish ..... 51. *scalaris* (Prov.)

56. Temples rather flat and strongly receding posteriorly; abdomen usually uniformly reddish at apex 57
Temples rounded and only moderately receding posteriorly; apical two or three abdominal tergites often conspicuously more or less blackish 60

57. Areolet rather large, recurrent vein received in or before middle; scape not conspicuously yellow below 58
Areolet small, recurrent vein received much beyond middle; scape conspicuously yellow below 59

58. Hind femora bright reddish ..... 52. *simulans* n. sp.
Hind femora uniformly black ..... 53. *arizonensis* n. sp.

59. Malar space very short, much less than one-third basal width of mandible; middle trochanters and femora entirely yellow ..... 54. *flavescens* n. sp.
Malar space fully one-third as long as basal width of mandible; middle trochanters and femora, except apex of latter, blackish ..... 55. *turmalis* n. sp.

60. Basal transverse carina of propodeum distinct ..... 56. *bellula* (D. T.)
Basal transverse carina of propodeum absent ..... 57. *nitida* n. sp.

61. Mesonotal carina terminating posteriorly in a conspicuous, rounded lobe, opposite basal angle of scutellum ..... 58. *lobata* n. sp.
Mesonotal carina not terminating in a lobe 62

62. Scape not conspicuously yellow below; middle femora of male prominently marked with blackish ..... 59. *deceptor* n. sp.
Scape conspicuously yellow below; middle femora of male entirely pale yellow. ..... 60. *australis* n. sp.

63. Gena with a conspicuous, rounded prominence situated on a level with lower extremity of eye; temples slightly diverging posteriorly, transverse diameter of head distinctly greater through temples than through eyes ..... 61. *tumida* n. sp.
Gena without such a prominence; temples parallel or more or less receding behind eyes, head narrower through temples than through eyes 64

64. Temples not receding for some distance behind eyes, then strongly curving to occiput; ocellocular space slightly greater than diameter of lateral ocellus; scape black. ..... 62. *pulchella* n. sp.
Temples receding behind eyes, evenly rounded to occiput; ocellocular space only one-half diameter of lateral ocellus; scape yellow below ..... 63. *ocellata* n. sp.

65. Abdomen almost entirely reddish; thorax and propodeum also sometimes largely reddish 66
Body entirely black 67

66. Thorax and propodeum uniformly black; propodeum flattened, or with only a very indistinct, median, longitudinal sulcus ..... 64. *egregia* (Vier.)
Thorax and propodeum reddish except mesosternum and a more or less distinct median stripe on mesoscutum which are blackish; median longitudinal sulcus of propodeum well defined ..... 65. *rufescens* n. sp.

67. Mesopleura shining; inner calcarium of hind tibia fully one-half as long as basi-tarsus; post-petiole distinctly broader than petiole ..... 66. *nigerrima* (Vier.)
Mesopleura rather dull; inner calcarium of hind tibia distinctly less than one-half length of basi-tarsus; post-petiole only slightly broader than petiole. ..... 67. *luctuosa* (Prov.)

68. Body entirely pale reddish brown and yellowish, without black markings. ..... 68. *pallescens* n. sp.
Head uniformly black; thorax and propodeum varying from entirely black to largely reddish but in latter case always with conspicuous black markings 69

69. Post-petiole with lateral surfaces not distinctly flattened and smooth or only faintly sculptured; pubescence of face rarely somewhat parted on either side; basal carina of propodeum usually well defined and extending laterally for some distance, with apices curved forward in direction of spiracles; propodeum of male with normal vestiture 70
Post-petiole with lateral surfaces distinctly flattened and shagreened; pubescence of face evenly parted on either side; basal carina of propodeum very short or absent; propodeum opaque in male, with very dense, short, velvety pubescence 79

70. Basal lateral areas of propodeum, before basal carina, polished; thorax and propodeum more or less marked with reddish ..... 69. *villosa* (Nort.)
Basal lateral areas not polished; thorax and propodeum, except rarely the apex of latter, uniformly black 71

71. Very large species (length 16–17 mm.); propodeum distinctly transversely rugulose beyond basal carina, the latter well defined with apices distinct and sharply bent forward in direction of spiracles; scutellum small, narrow; sheath slender; temples strongly receding; front concave; areolet moderately broad; wings with smoky yellowish tinge; petiole often stramineous; legs yellow and black, without reddish markings 72
Smaller species (length not exceeding 13 mm.); propodeum more irregularly rugulose; otherwise not entirely as above 75

72. Occipital and hypostomal carinae uniting distinctly before base of mandible.....73
Occipital and hypostomal carinae not uniting before base of mandible.....74

73. Tegulae bicolored, yellow and brown; middle femora yellow on anterior surface. .....70. *robusta* n. sp.
Tegulae dark brown; middle femora black except at apex.....71. *conformis* n. sp.

74. Front and middle trochanters and femora marked with blackish on posterior surface. .....72. *major* (Cress.)
Front and middle legs beyond coxae entirely yellow.....73. *magnifica* n. sp.

75. Petiole yellowish, paler than post-petiole; scape largely yellowish; propodeal sulcus narrow; second discoidal cell strongly narrowed at base, the second abscissa of discoideus approximately one-half as long as third.....74. *brachiator* (Say)
Petiole and post-petiole reddish or more or less black, sometimes entirely black; scape blackish; propodeal sulcus moderately broad; second discoidal cell only moderately narrowed at base, the second abscissa of discoideus much more than one-half as long as third 76

76. Occipital and hypostomal carinae not uniting before base of mandible..... .....75. *johnsoni* n. sp.
Occipital and hypostomal carinae uniting distinctly before base of mandible.....77

77. Mesonotal carina terminating in a conspicuous lobe opposite basal angle of scutellum; tegulae dark brown or black.....76. *fuscitarsis* Vier.
Mesonotal carina not terminating in such a lobe; tegulae yellowish or bicolored, yellow and brown 78

78. Mesopleura with large, crowded, and often confluent punctures; apex of propodeum more or less reddish; hind tibia with a conspicuous pale stripe posteriorly..... .....77. *ellopiae* Wly.
Mesopleura with moderate sized, evenly spaced punctures; propodeum entirely black; hind tibia without a conspicuous pale stripe.....78. *quebecensis* n. sp.

79. Thorax usually conspicuously marked with reddish, very rarely entirely black; petiolar segment predominantly reddish; hind femora varying from uniformly reddish to black.....79. *vitticollis* (Nort.)
Thorax entirely black; petiolar segment with blackish color predominating, sometimes more or less reddish especially in lateral regions; hind femora uniformly black (Western N. A.).....80. *pilosa* n. sp.

A description of species commences on next page.

DESCRIPTIONS OF SPECIES

Group I *(kukakensis)*

1. **Campoplegidea kukakensis** (Ashm.)

Zachresta kukakensis Ashmead, Proc. Wash. Acad. Sci., IV, 235, 1902.
Anisitsia kukakensis Ashm., Viereck, Proc. U. S. N. M., XLII, 632, 1912.

Type—Male, from Kukak Bay, Alaska, No. 5681 in United States National Museum.

Discussion of this species is based on the original description and a few additional notes on the type. For convenience it is dealt with in a separate group but further knowledge of the species will be required to determine its exact relationships to other groups in the genus.

Kukakensis may be distinguished at once from all other members of the genus except *canadensis*, *luctuosa* and *nigerrima* by the entirely black abdomen. Except in these four species the abdomen is always conspicuously, sometimes entirely, reddish. *Kukakensis* differs from *canadensis* in being considerably smaller (length 8 mm.) with the petiolar segment decurved, the propodeal carinae very weak, and the hind tibia uniformly blackish. In *canadensis* the length is 15 mm., the petiolar segment is not decurved, the propodeum has well defined transverse carinae, and the hind tibia is black, with a broad, yellow annulus just before the base. *Luctuosa* and *nigerrima* resemble each other very closely and both differ from *kukakensis* in their larger size (length 13–14 mm.) and much more elongate propodeum, which bears a distinct basal carina, the latter curved forward at its apices. They also have the petiolar segment straight. The form of the third tergite in *kukakensis* is not known but in *luctuosa* and *nigerrima* it has the lateral margins inflexed, and in the females of these species the ovipositor and sheath are as long as the petiolar segment

The following description of *kukakensis* is formulated from the original description and the notes at hand on the type.

Male—Length 8 mm. Occipital and hypostomal carinae uniting at a point distant from base of mandible almost two-thirds basal width of latter; areolet petiolate, second recurrent received at middle; propodeum rather short, abruptly sloping posteriorly, apex not attaining middle of dorsal surface of hind coxae; basal transverse propodeal carina very weak, apical carina absent; petiole without lateral foveae before spiracles; petiolar segment slightly decurved.

Black; mandibles ferruginous; palpi fuscous; tegulae black; legs black except as follows: a pale spot on front coxae and trochanters, front femora beneath, front and middle tibiae, rufous; front and middle tarsi dark fuscous, except narrowly at sutures of segments. Wings almost hyaline; stigma and veins dark brown.

Group II *(diversa)*

The following fifteen species form a group, the principal characteristics of which are as follows: size medium to large; thorax rather stout; scutellum large, broad; propodeum short, its apex rarely extending distinctly

beyond basal third of dorsal surface of hind coxa and never beyond middle; propodeal carinae usually distinct, apical transverse carina frequently extending far forward on either side of median sulcus; plica of first segment of abdomen scarcely longer than that of second; second abdominal tergite rather short with spiracle usually located at or only slightly beyond middle of lateral margin. Except in one species *(vara)* the petiole bears a large, deep fovea, on either side, a short distance before the spiracle, this character being one of the most distinctive of the group. The last three species of the group differ from all the preceding in having the lateral margins of the third tergite entirely uninflexed.

2. **Campoplegidea vara** n. sp.

Plate I, Fig. 1; Plate III, Fig. 6.

Readily distinguished from all other members of this group by the absence of distinct petiolar foveae. Instead, on either side of the petiole there is a very elongate, shallow impression, formed by a pair of weak, gradually converging carinae, which meet at a point far in front of the spiracle.

Female—Length 12 mm. Temples weakly rounded, strongly receding; malar space one-fourth basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible two-fifths basal width of latter; ocellocular space slightly greater than diameter of lateral ocellus; face slightly narrowed below, including clypeus a little longer than broad; front shallowly concave, dullish, with a fine median carina. Mesopleura dullish with rather small, well spaced punctures, speculum and intervals between punctures finely sculptured; prepectoral carina broadly curving to middle of anterior margin of mesopleuron; mesoscutum and scutellum dull, densely, shallowly punctate, finely sculptured; scutellum broad, densely punctate at apex, lateral margins carinate almost to apex, carina at base continuous with mesonotal carina; propodeum short, extending to basal third of dorsal surface of hind coxa; dorsal surface of propodeum evenly, convexly rounded to sides; median longitudinal sulcus shallow, indistinct on basal half of propodeum; basal transverse propodeal carina with its lateral sections diverging to form an acute angle; apical transverse carina distinct on either side with much weaker median portions extending forward, obliquely, on either side of longitudinal sulcus; propodeum dull, basal half or more finely, evenly roughened with numerous, poorly defined punctures, apically more irregularly rugulose; areolet moderately large, petiole short; second recurrent distinctly incurved in region of bulla; outer posterior angle of second discoidal cell slightly acute; nervulus slightly post-furcal; longer calcarium of hind tibia a little more than one-half as long as basi-tarsus. Spiracle of second abdominal tergite at middle; plicae of first two segments equal; lateral margin of third tergite inflexed except at extreme apex; sheath short, rounded at apex.

Head, thorax, propodeum, first abdominal segment and basal two-thirds of second tergite, black; remainder of abdominal segments reddish; sheath brownish-black; all coxae and hind legs black; hind tibia with a sordid yellowish streak above toward base; hind calcaria yellow; front and middle legs beyond coxae with yellowish ground colour, their trochanters and

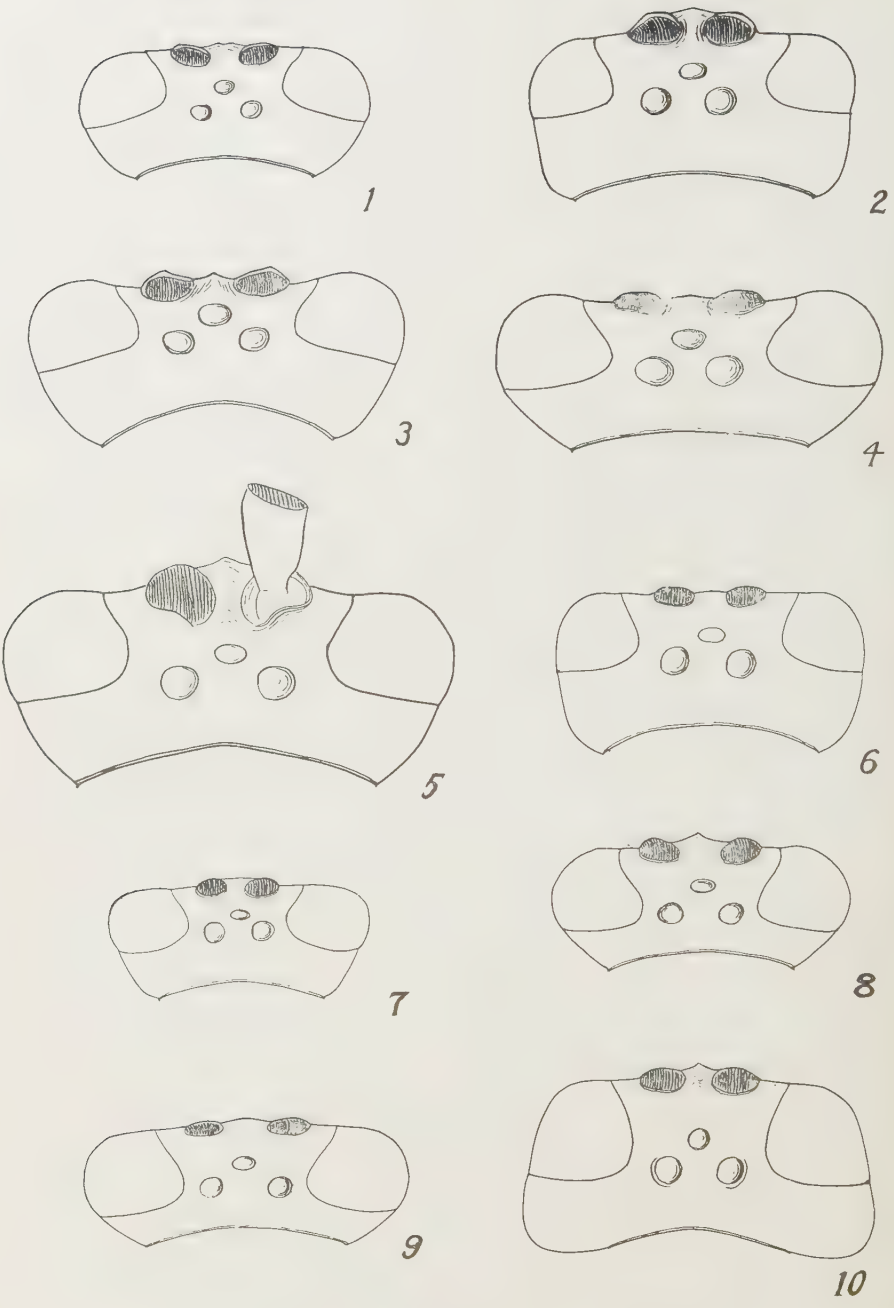

PLATE I. HEADS OF CAMPOPLEGIDEA SPECIES

1. *Campoplegidea vara* n. sp.; 2. *C. canadensis* n. sp.; 3. *C. diversa* (Nort.); 4. *C. argentea* (Nort.); 5. *C. semirufa* (Prov.); 6. *C. laticincta* (Cress.); 7. *C. diversicolor* Vier.; 8. *C. interstitialis* n. sp.; 9. *C. arizonensis* n. sp.; 10. *C. tumida* n. sp.

femora brownish-black except anteriorly, tips of tarsi pale brown; tegulae, wing bases, base of mandibles and palpi, yellow; wing membrane faintly brownish, veins and stigma dark brown.

Holotype—♀, Baddeck, N.S., June 20, 1936, (T. N. Freeman); No. 4491 in the Canadian National Collection, Ottawa, Ont.

Allotype—♂, Canaan Mt. (Canaan), Ct., June 24, 1935, (A. Stone).

Paratypes—♀, La Trappe, Que., June 11, 1933, (G. Chagnon); ♀, Harrisburg, Pa., June 11, (J. N. Knull); ♂, New Lisbon, N.J., May 5, 1924, (H. C. Hallock); ♀, Kazubazua, Que., June 26, 1933, (G. S. Walley); ♀, Macdiarmid, Lake Nipigon, Ont., July 16, 1922, (N. K. Bigelow). Allotype and first three paratypes in United States National Museum.

3. **Campoplegidea canadensis** n. sp.

Plate I, Fig. 2; Plate II, Fig. 3.

The uniformly black abdomen of this species will at once distinguish it from all others in this group and from all members of the genus here treated, except those mentioned in the discussion under *kukakensis*.

The present species is exceedingly similar to *C. myrtillus* Desv., of Europe and may eventually prove to be merely a race of that species. Mr. J. F. Perkins of the British Museum has kindly compared Canadian specimens with the type of *myrtillus* and has supplied the following notes. In *canadensis* "epicnemia (= prepectoral carina) of the mesosternum excised at the median sulcus which is therefore not closed anteriorly; frontal carina very strong; mesonotum somewhat shining; propodeum of the male with the costae much stronger". In the type of *myrtillus* "epicnemia not excised, median sulcus closed anteriorly; frontal carina distinct, but weak; mesonotum dull; propodeum with the costae much weaker". Sketches of the first abdominal segment and propodeum of *myrtillus* and *canadensis* show that in the former the post-petiole is much less abruptly elevated above the petiole and the propodeum is devoid of carinae except for the basal carina and short oblique portions of the apical one, and a brief stub of a median longitudinal carina at apex. In *canadensis* the post-petiole is strongly and rather abruptly elevated above the petiole, the apical carina of propodeum extends forward to join the basal carina and delimit an areola, and the median longitudinal carina at the apex of propodeum extends further anteriorly than in *myrtillus*.

Female—Length 15 mm. Temples scarcely receding for some distance behind eyes, then rather strongly rounded to occiput; head thick antero-posteriorly; malar space two-fifths basal width of mandible; cheeks broad, convex; occipital and hypostomal carinae uniting very close to base of mandible; ocellocular space equal to diameter of lateral ocellus; face with parallel sides, including clypeus slightly broader than long; clypeal foveae large, deep; face rather shining, conspicuously pubescent, with shallow, dense punctures; front concave, dullish, indistinctly punctate; median vertical carina distinct; antennae stout, flagellar segments, except those near base and apex, slightly broader than long. Thorax shining, densely punctate, intervals between mesopleural punctures only faintly sculptured, speculum polished; prepectoral carina broadly curved above; propodeum broad, short, extending to basal third of dorsal surface of hind coxae;

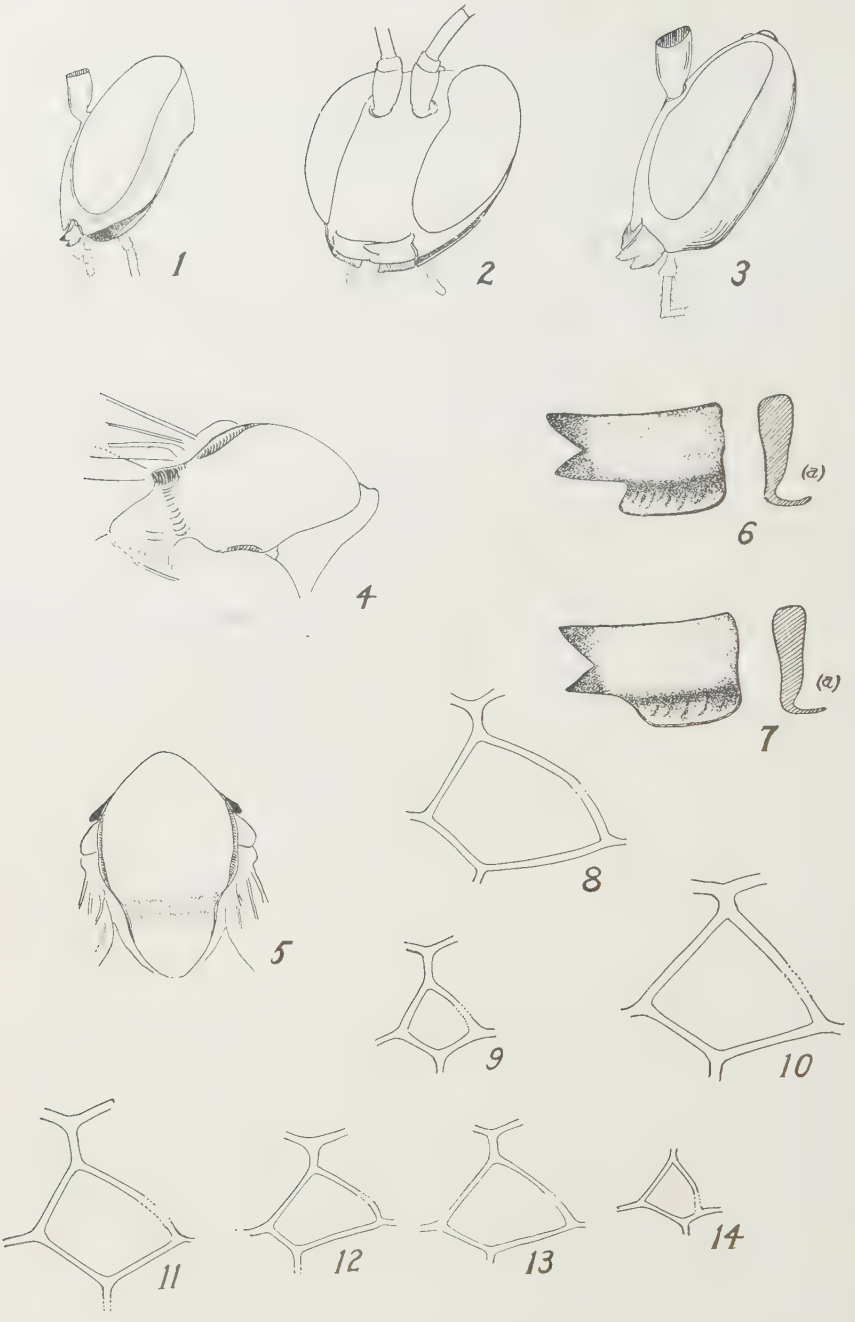

PLATE II. HEADS, MANDIBLES, THORACES AND WING VEINS OF CAMPOPLEGIDEA SPECIES

1. *Campoplegidea varicoxa* Vier. lateral aspect of head; 2. *C. assita* (Nort.) anterior-lateral aspect of head; 3. *C. tumida* n. sp. lateral aspect of head; 4. *C. diversicolor* Vier. dorso lateral aspect of thorax; 5. *C. minor* (Prov.) dorsal aspect of thorax; 6. *C. assita* (Nort.) mandible; 6*(a)*. diagram of cross-section of same; 7. *C. montrealensis* Vier. mandible; 7*(a)*. diagram of cross-section of same; 8. *C. nigerrima* (Vier.) areolet; 9. *C. scamansi* Vier. areolet; 10. *C. diversa* (Nort.) areolet; 11. *C. fuscitarsis* Vier. areolet; 12. *C. ellopiae* Wly. areolet; 13. *C. quebecensis* n. sp. areolet; 14. *C. bellula* (D. T.) areolet. (Figures 8–14 drawn to same scale)

median longitudinal sulcus very broad; basal transverse propodeal carina distinct, apices curving forward above spiracle to attain base of propodeum; apical transverse carina distinct on sides of propodeum, dorsally extending forward as a very irregular carina on either side of sulcus to attain lateral arms of basal carina; propodeum rather shining, feebly sculptured before basal carina, beyond with numerous, very irregular, anastamosing rugulae, and a short stub of a median longitudinal carina at apex; areolet broad, sessile, second recurrent received before middle, latter weakly curved at bulla; outer posterior angle of second discoidal cell acute; nervulus postfurcal by almost one-half its length; legs stout; hind femora four and one-half times as long as broad; calcaria short, curved at tip, longer calcarium of hind tibia distinctly less than one-half as long as basitarsus; tarsal segments slightly thickened at apices; claws with seven or eight short teeth. Petiolar fovea very close to spiracle, lying below a dorso-lateral carina which extends for some distance along petiole from base of post-petiole; post-petiole very broad, elevated; second tergite short, spiracle at middle; plicae of first two segments equal; lateral margin of third tergite inflexed except at apex; sheath short, rounded at apex.

Body black; antennae black; mandibles, palpi, tegulae and wing bases yellow; coxae black, the anterior pair with a yellow spot at apex; front trochanters yellow anteriorly, brown posteriorly; remainder of front legs yellowish-testaceous, the femora narrowly brown behind at base; middle legs black at base with apex of femora and segments beyond yellowish, the tarsi more or less suffused with testaceous; hind legs black to apex of femora; hind tibia with a broad yellow annulus, the base narrowly, and the apical fourth black; calcaria yellowish; hind tarsi yellowish-testaceous; first three abdominal plicae more or less yellowish suffused with brown; sheath black except for brownish apex; wing membrane pale brownish, stigma yellowish brown, veins darker.

Male—Length 13.5 mm. Agreeing in structure with the female except as follows: antennae less stout; transverse carinae of propodeum stronger, anterior portions of apical carina quite regular; median propodeal sulcus very shallow.

Differs in colour from the female in having the front and middle coxae yellow except at base, and the remainder of the four anterior legs yellow except for a reddish suffusion on the femora posteriorly; first three abdominal plicae entirely yellow.

Holotype—♀, Macdiarmid, Lake Nipigon, Ont., July 10, 1921, (N. K. Bigelow); No. 4492 in the Canadian National Collection, Ottawa, Ont.

Allotype—♂, Cochrane, Alta., June 11, 1915, (E. H. Strickland), (abdomen detached).

Paratypes—♂, same data as allotype, (head missing); ♀, Canim Lake, B.C., June 22, 1938, (G. S. Walley).

4. **Campoplegidea signata** Vier.

Campoplegidea signata Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 261–262, 1925.

Structurally this species resembles *diversa* and *downesi*, but can be distinguished from both by the low, flattened scutellum, and the reddish or rufo-piceous hind femora. It differs further from *downesi* in not having

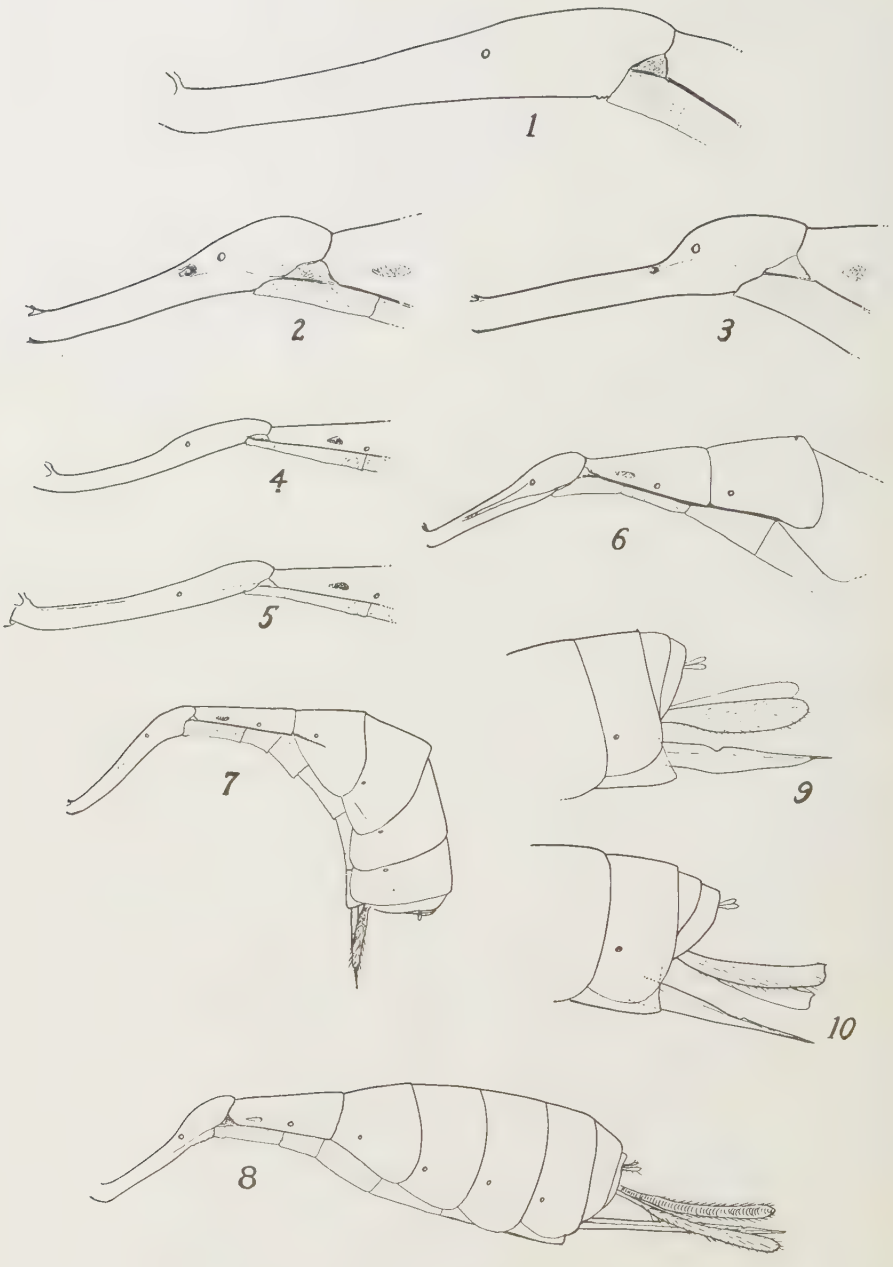

PLATE III. ABDOMENS OF CAMPOPLEGIDEA SPECIES

1. *Campoplegidea rufescens* n. sp.; 2. *C. diversa* (Nort.); 3. *C. canadensis* n. sp.; 4. *C. bellula* (D. T.); 5. *C. lobata* n. sp.; 6. *C. vara* n. sp.; 7. *C. pectoralis* n. sp.; 8. *C. caudata* n. sp.; 9. *C. diversa* (Nort.); 10. *C. major* (Cress.).

the apical tergites conspicuously blackish, and from *diversa* in the much narrower, and often incomplete hind tibial annulus. The female sheath is about the same length, but narrower and more rounded at the apex than in *diversa* and *downesi*. *Signata* occupies the same general territory as *diversa* but appears to be a much rarer species.

Type—♀, No. 1358 in the Canadian National Collection, Ottawa, Ont.

Female—Agrees with the description of *diversa* except as follows: junction of occipital and hypostomal carinae distant from base of mandible one-half to two-thirds basal width of latter; scutellum densely punctate and flattened; apex of propodeum usually with a short stub of a median longitudinal carina; sheath as noted above. Middle coxae entirely black; femora reddish or rufo-piceous; hind tibia largely blackish with a narrow, sordid yellowish annulus which lies near the base and often does not entirely encircle the segment; crests of third and following tergites usually streaked with blackish; wings faintly brownish.

Male—Resembles the female. The oedeagus is less conspicuously beak-like at apex than *diversa*, with its lower, sub-apical margin not minutely serrate.

Host—One female from Aweme, Man., reared from an unknown Noctuid.

Distribution—The collection at hand contains five males and nine females from the following localities: N.B.: Fredericton; Que.: Kazubazua; Ont.: Constance Bay, Lake Abitibi, Sudbury; Man.: Aweme, Transcona; Sask.: Earl Grey. Collecting dates range from June 6 to July 21.

Remarks—A single damaged female bearing the data Prince Rupert, B.C., July 3, 1924, (E. R. Buckell) is in the National Collection. It differs in structure from the above mentioned specimens only in having the second tergite more elongate. In colour it differs in having the hind femora entirely black and the abdomen black with a reddish suffusion on the apex of the second and the sides of the third and fourth tergites. The abdominal colour appears to be somewhat abnormal and partly due to staining. The specimen is for the present referred doubtfully to *signata*.

5. **Campoplegidea diversa** (Nort.)

Plate I, Fig. 3; Plate II, Fig. 10; Plate III, Figs. 2, 9.

Campoplex diversus Norton, Proc. Ent. Soc. Phila., I, 366, 1863.
Campoplex wyomingensis Viereck, Trans. Am. Ent. Soc., XXXII, 242, 1906. (New synonymy).
Campoplegidea walleyi Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 262, 271, 1925. (New synonymy).

Types—The type of *diversa* is a female in the Peabody Museum of Natural History, Yale University, New Haven, Conn.; the type of *wyomingensis* is in the Entomological Museum of the University of Kansas, Lawrence, Kan.; that of *walleyi* is a female, No. 1409 in the Canadian National Collection. The notes on variation given by Norton lead the writer to suspect that Norton's type series may contain more than one species. The type locality of *diversa* is Massachusetts.

This is a rather common species in Eastern Canada. A specimen from Saskatchewan determined by Viereck as *wyomingensis* is in the National Collection, and has been found to pertain to this species. Mr. R. A. Cushman who has examined the type of *wyomingensis* has kindly informed me that he considers it to be a specimen of *diversa*. The type series of *walleyi* has been studied by the writer.

This species is very similar in structure to *downesi* from which it may be distinguished readily by the differences in colour noted in the key. *Diversella* and *signata* also resemble *diversa* but may be distinguished as noted in the discussions of those species.

Female—Length 12–14 mm. Temples weakly rounded, rather strongly receding; malar space two-fifths basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-third to almost one-half basal width of latter; ocellocular space equal to diameter of lateral ocellus; face, including clypeus, slightly broader than long; front concave, with a fine, median carina. Mesopleura feebly shining, intervals between punctures finely sculptured, and about equal to diameter of punctures; speculum more shining, minutely sculptured, except for a small area which is sometimes perfectly smooth; prepectoral carina broadly curved above to middle of anterior margin of mesopleuron; mesoscutum and scutellum dull, the former densely punctate, latter more sparsely so, both with intervals finely, evenly sculptured; scutellum convex, lateral margins carinate except apically; propodeum broad, short, extending only slightly beyond basal third of dorsal surface of hind coxae; median longitudinal sulcus distinct, smooth on basal half or more, beyond irregularly, more or less transversely rugulose; basal and apical transverse carinae distinct, the latter usually extending far forward on either side of median sulcus; propodeum with numerous, fine, irregular, anastamosing rugulae, apically more coarsely rugulose; areolet rather large and broad, usually petiolate; second recurrent nearly straight; outer posterior angle of second discoidal cell slightly acute; nervulus post-furcal by almost one-half its length. Petiolar fovea large, close to spiracle; spiracle of second tergite at middle or almost; lateral margin of third tergite sharply inflexed except near apex; plicae of first two segments equal; sheath short and broad, broadly rounded at apex.

Head, thorax, propodeum, first abdominal segment and base of second tergite black; front and middle coxae except yellowish spot at apices, posterior surface of front trochanters and femora, middle trochanters and femora except stripe on anterior surface, hind legs except calcaria and basal two-thirds of tibia, black; mandibles except tips, palpi, tegulae, legs except as noted above, yellow, with the apical segment of front and middle tarsi brownish; wings hyaline, sometimes faintly tinged with brown, veins and stigma brown; abdomen reddish except as noted above, occasionally with a blackish streak on the crest of tergites beyond second; sheath black, apex brownish; plicae of first two segments more or less yellowish.

Male—Agreeing very well with the above description of the female. The oedeagus in lateral aspect presents a downward curved, beak-like apex, with the lower margin, sub-apically, very finely serrate.

Of the ninety-one specimens examined, eighty are females. A few individuals have the scape obscurely marked with yellowish below, and in an occasional example the hind tibial band is narrower than usual; otherwise little variation has been observed.

Hosts—Schaffner and Griswold (U.S.D.A. Misc. Pub. No. 188, p. 148, 1934) record *Graptolitha* sp. and an unidentified Noctuid as hosts for this species.

Distribution—Common in Northeastern America and extending west to Alberta and British Columbia. Specimens before the writer bear dates ranging from June 1 to July 17th, the majority of the specimens being captured in late June and early July. The following localities are represented. N.S.: Kentville; N.B.: Fredericton; QUE.: Aylmer, Brome, Cascapedia, Covey Hill, Georgeville, Hemmingford, Hull, Kazubazua, Knowlton, Lachute, Marks, Mt. Lyall; ONT.: Bell's Corners, Chatham, Constance Bay, Jockvale, Normandale, Orillia, Ottawa, Smoky Falls (Mattagami R.), Vineland Station, Vittoria; MAN.: Aweme; SASK.: Saskatoon; ALTA.: Edmonton; B.C.: Likely.

6. **Campoplegidea diversella** n. sp.

Resembling *diversa* in general body form and colour, but smaller, with temples a little more rounded, the combined occipital and hypostomal carina higher, pleura more shining and petiolar fovea more remote from spiracle.

Female—Length 11.5 mm. Temples, especially in lower portion, rather strongly curved and only moderately receding; genae with a slight impression adjacent to the combined occipital-hypostomal carina, the latter rather high and in length equal to one-third basal width of mandible; malar space one-third basal width of mandible. Mesopleura with rather large punctures, strongly shining between punctures; speculum, in part, polished and unsculptured; scutellum without lateral carinae, disk with large and narrowly separated punctures; propodeum short, rather evenly rugoso-punctate, basal transverse carina forming an obtuse angle at middle, apical transverse carina not extending forward beyond apical fourth of propodeum, spiracle lying close to pleural carina and usually joined to it by a broad carina; areolet narrow, sessile, second recurrent at middle; nervulus slightly post-furcal. Petiolar fovea moderately large, as far in front of spiracle as distance from spiracle to apex of tergite; spiracle of second segment remote from margin of tergite, mid-way between base and apex of tergite; basal half of lateral margin of third tergite inflexed.

Head, thorax, propodeum, first abdominal segment, second tergite except along lateral margins and apical fourth, black; mandibles, palpi and tegulae yellow; scape with a yellow spot below; front coxae black with a yellow spot at apex, remainder of front legs yellow; middle legs brownish-black to near apex of femora, beyond, yellow, with the ultimate tarsal segment somewhat brownish; hind legs with coxae, trochanters and femora black, basal two-thirds of tibia yellow, apical third dark brown, tarsi brown, paler below; stigma and veins brown, membrane faintly brownish; abdomen reddish, except as noted above; sheath blackish with apex reddish-brown.

Holotype—♀, Texas (Collection Belfrage); in the United States National Museum, Washington, D.C.

Allotype—♂, Ile Jesus, Que., June (Chagnon); No. 4493 in the Canadian National Collection, Ottawa, Ont.

Paratype—♀, same data as holotype.

In addition to the type specimens I have seen a specimen from the Collection of the United States National Museum, bearing the data "Utica, N.Y. (Collection T. Pergande)". It departs from the above description only in having the areolet briefly petiolate, with the second recurrent much beyond the middle. In size it is slightly smaller. The allotype is slightly smaller than the type, (length 8.5 mm.) and has the propodeum somewhat flattened dorsally without a distinct median sulcus. The middle coxae have a yellow spot at apex and the middle femora are almost entirely yellow. The areolet is briefly petiolate with the second recurrent slightly beyond the middle. Otherwise it agrees closely with the foregoing description of the female.

7. **Campoplegidea downesi** Vier.

Campoplegidea downesi Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 262, 265, 1925.
Campoplegidea vadosa Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 261, 269, 1925. (New synonymy.)
Campoplegidea walleyi Viereck, Trans. Roy Soc. Can., XIX, Sec. V, 262, 271, 1925. (One paratype, nec type.)

Types—The types of *downesi* and *vadosa* are Nos. 1399 and 1407 respectively in the Canadian National Collection. *Downesi* is selected as the valid name of the species for the following reasons: the description has page precedence in Viereck's text; it is represented by a series of specimens; the type locality is known with certainty while that of *vadosa* is in doubt.

Vadosa Vier. is clearly a synonym of *downesi*. The type bears no locality label and judging from the known distribution of the species it appears doubtful if it came from Ottawa, Ontario, as stated by Viereck. Viereck's Waterton, Alberta, specimen of *walleyi* is also referred to this species. As noted below, *planatella* Vier. may prove to be the same as *downesi*.

The foregoing structural description of *diversa* will apply equally well to the present species. In colour it differs from the description of *diversa* as follows: tegulae dark brown; middle femora blackish except at apex; middle tibiae pale brownish on posterior surface especially toward apex; middle tarsi uniformly brownish; hind tibia with base narrowly blackish, followed by a more or less incomplete, sordid yellowish annulus extending almost to middle of tibia; calcaria more or less brownish; fifth and following abdominal tergites more or less broadly blackish above, the apical two tergites usually entirely black.

Distribution—Three males and eight females have been studied from the following localities. Ont.: Ottawa (type of *vadosa*, locality in doubt); Alta.: Waterton; B.C.: Vancouver, Victoria; Calif.: (G. Alpine Creek) Tahoe.

8. **Campoplegidea planatella** Vier.

Campoplegidea planatella Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 261, 267, 1925.

Type—No. 1404 in the Canadian National Collection, Ottawa, Ont.

Viereck's type, a male from Waterton, Alta., is the only known specimen. Except for the fact that the propodeal sulcus is very poorly defined, and the hind tibiae are entirely blackish, and the tegulae yellowish, this specimen agrees with the above characterization of *downesi*. Such differences are liable to prove inconstant in a series but until variation has been demonstrated the synonymy is withheld.

9. **Campoplegidea confluens** n. sp.

Structurally very similar to *diversa* and *downesi*, and resembling the latter closely in colour, but with much broader hind tibial annulus than in that species.

Differs from the description of *diversa* as follows.

Female—Length 15 mm. Temples a little more strongly receding; junction of occipital and hypostomal carinae distant from base of mandible one-half basal width of latter; ocellocular space not quite equal to diameter of lateral ocellus. Mesopleura with a row of confused, confluent punctures extending from prepectoral carina to fovea; scutellum rather densely punctate; median longitudinal sulcus of propodeum transversely rugulose even at base; apical transverse carina unusually well defined on either side of sulcus, and extending at least as far forward as apices of basal carina; areolet only moderately broad; second recurrent distinctly bent inward at bulla. Petiolar fovea very large, a little further in front of spiracle than in *diversa*; slightly more than basal half of lateral margin of third tergite inflexed; sheath moderately broad, apex truncate.

Front and middle coxae and trochanters entirely black; front femora and apical half of middle femora reddish; hind tibia narrowly blackish at base, more broadly so at apex; middle tarsi brownish; fifth and following tergites black; tegulae dark brown; sheath black, more or less brownish at apex; wings distinctly tinged with brownish, stigma yellowish-brown, veins dark brown. Colour otherwise as in *diversa*.

Male—Claspers unusually long and narrow; oedeagus bluntly rounded at apex, without beak-like termination, the lower margin not serrate. Colour as in female.

Holotype—♀, Knowlton, Que., July 20, 1936, (G. S. Walley); No. 4494 in the Canadian National Collection, Ottawa, Ont.

Allotype—♂, Orillia, Ont., June 11, 1925, (C. H. Curran).

Paratypes—♂, Milwaukee, Wis., (Collection United States National Museum); ♀, Pt. Sydney, Ont., July 23, 1919, (N. K. Bigelow).

10. **Campoplegidea associata** n. sp.

Easily distinguished from most species in the present group by its smaller size and more extensively polished speculum.

Female—Length 9 mm. Temples moderately receding; junction of occipital and hypostomal carinae as in *diversella*; malar space one-third basal width of mandible; ocellocular space equal to diameter of lateral ocellus.

Mesopleura with moderately large, well spaced punctures, interspaces rather shining, speculum in part polished, region above speculum shining, minutely shagreened and rugulose. Scutellum with carinae only at base, disk with large, narrowly separated punctures; propodeum short, broadly sulcate, basal and apical transverse carinae distinct, the latter extending forward to invade basal half; propodeum with shallow, narrowly separated punctures, more or less confused by rugosity, especially laterally and apically; areolet sub-sessile, somewhat oblique, second recurrent distinctly beyond middle; nervulus slightly post-furcal. Petiolar fovea rather close to spiracle; spiracle of second tergite slightly beyond middle, twice its own diameter from lateral margin; basal half of lateral margin of third tergite narrowly inflexed.

Except in leg colour and the absence of a yellow spot on scape, agrees with the description of *diversella*. Coxae black, the front pair sordid yellowish at apex; trochanters brownish to blackish; front femora mostly yellowish with more or less pale brownish toward base; middle femora dark reddish-brown with apex yellowish; remainder of front and middle legs yellow, the ultimate tarsal segments more or less suffused with pale brownish; hind femora dark reddish-brown; hind tibia with extreme base brown, followed by a yellowish area which extends almost to middle, thence gradually shading to brown; hind tarsi brown with extreme bases of segments yellowish; stigma pale brown, veins brown, membrane with faint brownish tinge.

Male—Agrees in structure with the female, except areolet distinctly petiolate. Differs in colour in having the middle coxae brownish at base with a large yellow spot below, both front and middle legs entirely yellow beyond coxae, and the hind femora more distinctly reddish.

Holotype—♀, Texarkana, Ark., March 26, 1907, (R. A. Cushman), "on *Carpinus carolinana*".

Allotype—♂, Logansport, La., March 24, 1908, (E. S. Tucker).

Paratype—♀, (no locality data), Collection C. V. Riley.

Types in Collection of United States National Museum. Paratype, No. 4915 in Canadian National Collection.

The paratype resembles the male in having the hind femora reddish.

11. **Campoplegidea argentea** (Nort.)

Plate I, Fig. 4.

Campoplex argenteus Norton, Proc. Ent. Soc. Phila., I, 365, 1863.
Campoplegidea citriscapa Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 262, 264, 1925. (New synonymy).

Types—The type of *argentea* is a female in the Peabody Museum of Natural History, Yale University, New Haven, Conn. The type of *citriscapa* is a female, No. 1360, in the Canadian National Collection.

Identification of this species is based on a homotype (Gahan, 1920) of *argentea* in the United States National Museum. Viereck's type of *citriscapa* has been studied and is undoubtedly the same species.

This species and *planata* are exceedingly similar, the only differences of note being given in the key. Both are distinctive in their large size, conspicuously hairy scutellum and propodeum, unusually long united occipital and hypostomal carina, strongly receding temples, narrow ocellocular space, narrow face and large eyes, transversely rugulose propodeum, and the more briefly inflexed margins of the third tergite.

Female—Length 15–16 mm. Junction of occipital and hypostomal carinae distant from base of mandible two-thirds basal width of latter; malar space one-fourth basal width of mandible; face, including clypeus, distinctly longer than broad; front concave, without median carina; ocellocular space distinctly less than diameter of lateral ocellus. Mesopleura dullish, speculum only feebly shining, latter entirely finely sculptured, with large, deep fovea; propodeum extending a little beyond basal third of dorsal surface of hind coxae; areolet large, broad; second recurrent curved; outer posterior angle of second discoidal cell acute; nervulus postfurcal by one-half its length. Petiolar fovea large, deep, a little further in front of spiracle than distance between spiracles; slightly less than basal half of lateral margin of third tergite inflexed; longer calcarium of hind tibia two-thirds as long as basi-tarsus.

Scape and pedicel bright yellow, sometimes with a brown stripe above; front femora largely yellow, posterior surface marked with brownish; narrow apices of hind femora yellowish. Colour otherwise as in *diversa*.

Male—Oedeagus bluntly rounded at apex. Front and middle femora usually entirely yellow. Otherwise as in female.

Distribution—Norton's types were from New York and Connecticut. Specimens are at hand (eight females and four males) from the following localities. QUE.: Hull; ONT.: Orillia; B.C.: Okanagan. N.Y.: (The Shack) McLean Reservation; MASS.: Williamstown; N.J.: Lakehurst; PA.: Glenside; VA.: (no locality given); ILL.: Chicago; MICH.: Whitefish Pt.; also a homotype (Gahan, 1920) bearing only the label "L. Sup." (?, Lake Superior).

12. **Campoplegidea planata** Vier.

Campoplegidea planata Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 262, 267, 1925.

Type—A female, from Ottawa, Ont., No. 1403 in the Canadian National Collection.

Agreeing with *argentea* except as noted in the key.

Distribution—One male and ten females have been studied from the following localities. QUE.: Aylmer, Knowlton, Sutton, Sweetsburg; ONT.: Merivale, Ottawa; N.Y.: Ithaca; MD.: Cabin John; ILL.: (no locality given).

13. **Campoplegidea semirufa** (Prov.)

Plate I, Fig. 5.

Campoplex semirufus Provancher, Nat. Can., XIII, 364, 1882; Pet. Faun. Ent. Can. Hymen., p. 786, 1883.
Campoplegidea okanaganensis Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 261, 270, 1925. (New Synonymy).

Types—Type of *semirufa*, No. 1024 in Quebec Public Museum; type of *okanaganensis*, No. 1402 in Canadian National Collection.

In this species the inflexed portion of the lateral margin of the third tergite is very short and sometimes scarcely apparent. In other respects the species resembles a number of the foregoing members of the *diversa* group, particularly *downesi* and *confluens*. It may be distinguished, however, from all other species here treated, by the unusual form of the margin of the antennal foramen. This latter character appears to approach the condition found in the European species *anceps* Holmg., in which the margins are auriculate.

The species is described as follows:

Female—Length 17 mm. Temples moderately rounded, rather strongly receding; malar space two-fifths as long as basal width of mandible; occipital and hypostomal carina uniting at a point distant from base of mandible three-fourths basal width of latter; face, including clypeus, slightly broader than long; front concave, with a short median carina; rim-like margin of antennal foramen strongly produced above antennae with three or four small carinae converging toward it, the region just dorsal to the elevated portion excavated slightly; ocellocular space slightly greater than diameter of lateral ocellus. Thorax dull, finely, densely punctate, finely sculptured between punctures; speculum dullish, sculptured; propodeum broad, short, apex extending almost to middle of dorsal surface of hind coxae; basal transverse propodeal carina distinct; apical transverse carina strong, extending forward on either side of sulcus as far as lateral arms of basal carina; median longitudinal sulcus strongly defined, posteriorly with a few transverse rugulae; propodeal spiracle five times as long as broad; areolet large, sessile, or with short petiole, second recurrent distinctly before middle; nervulus post-furcal by nearly one-half its length. Petiolar fovea deep, slightly further in front of spiracle than distance between spiracles; second tergite with spiracle slightly beyond middle.

Head, thorax, coxae, middle legs almost to apex of femora and hind legs to apex of femora, first abdominal segment, basal two-thirds of second, and beyond the base of fifth segment, black; front trochanters brownish; front femora, and middle at apex, pale reddish; front and middle tibiae, front tarsi, hind tibia except narrowly at base and apex, brownish-yellow; base and apex of hind tibiae, middle and hind tarsi, yellowish-brown to blackish; abdomen, except as noted above, reddish; wings with faint brownish tinge, stigma and veins dark brown.

Host—Pheosia rimosa Pack.

Distribution—The type of *semirufa* is probably from Quebec; that of *okanaganensis* is from Okanagan, B.C. and a paratype is from Transcona, Man. Three additional females have been studied from the collections of the United States National Museum. These bear the following data. Rome, N.Y., June 22, 1927, (Ex. *Pheosia rimosa*, Gypsy Moth Lab. No. 12198-M5); Vt. Thro. C. V. Riley, 1888; Copeland Park, Boulder Co., Colo., Sept. 4, 1907, (Glen M. Hite).

14. **Campoplegidea vibecifera** Vier.

Campoplegidea vibecifera Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 262, 270, 1925.

Type—No. 1408 in the Canadian National Collection.

Known only from the single male type specimen which bears no data other than Viereck's type label. The specimen evidently came from the Harrington Collection and on this basis Viereck assumed the locality to be Ottawa, Ont., but this cannot be verified.

The species is very similar to *egregiata* and may represent the male of that species. The following notes will supplement the original description.

Male—Temples strongly receding; malar space one-third basal width of mandible; occipital carina weakly sinuous ventrally, not uniting with hypostomal carina before base of mandible; ocellocular space slightly less than diameter of lateral ocellus; face, including clypeus, very nearly as broad as long; front concave. Thorax dull; mesopleura opaque, finely, evenly sculptured between punctures and on entire speculum; scutellum large, broad, lateral carinae distinct except at apex; areolet rather oblique, second intercubitus distinctly curved behind; second recurrent almost straight, outer posterior angle of second discoidal cell rectangular; nervulus post-furcal by more than one-half its length; longer calcarium of hind tibia distinctly more than one-half length of basitarsus. Petiolar fovea large, as far in front of spiracle as distance between spiracles; second tergite short, spiracle slightly beyond middle.

Hind femora dark reddish-brown with extreme apex sordid yellowish; wings faintly brownish; post-petiole in lateral aspect dusky reddish. The specimen has the appearance of being slightly immature.

15. **Campoplegidea egregiata** Vier.

Campoplegidea egregiata Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 262, 266, 1925.

Type—No. 1401 in the Canadian National Collection.

Known only from the female type from Sidney, B.C.

Very similar to *vibecifera* which is perhaps the male of the present species. Agrees with the foregoing description of *vibecifera*, the only differences noted being given in the key.

16. **Campoplegidea stricklandi** Vier.

Campoplegidea stricklandi Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 262, 269, 1925.

Type—No. 1406 in the Canadian National Collection.

The type which is the only known specimen is a male from Waterton, Alta.

Resembles *downesi* but differs structurally, and with the hind tibia broadly yellowish banded. The following characters are noteworthy.

Temples strongly receding though less so than in *vibecifera*; ocellocular space scarcely equal to diameter of lateral ocellus. Mesopleura opaque, sculptured as in *vibecifera* but speculum more shining. Areolet sessile, slightly oblique, second intercubitus curved. Petiolar fovea slightly further in front of spiracle than distance between spiracles.

Group III *(montrealensis)*

Moderately large species (length 10–12.5 mm.) differing from all other members of the genus in having the lower margin of the mandible with a broad, forward-projecting flange or lamina which teminates distally in a sharp curve or an abrupt truncation; temples moderately to strongly receding; petiole without fovea; spiracle of second tergite distinctly beyond middle; lateral margins of third tergite not inflexed. In two species (*montrealensis* and *assita*) the occipital carina is unusually strongly produced below.

17. **Campoplegidea montrealensis** Vier.

Plate II, Figs. 7, 7*(a)*.

C. (Viereckiana) montrealensis Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 174, 181, 1926.

C. (Viereckiana) mimetica Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 173, 175, 1926 (Allotype).

Types—The type of *montrealensis* is a male, No. 1762 in the Canadian National Collection. The allotype of *mimetica* bears No. 1751 in the same collection.

This species is very similar to *assita*, the principal differences being mentioned in the description of *assita*. The males of both species differ markedly in colour from the females.

Female—Length 10.5–11 mm. Temples rather flat and strongly receding; occipital carina strongly produced in lower region, not uniting with hypostomal carina before base of mandible; mandibular lamina terminating distally in a sharp curve; ocellocular space about two-thirds diameter of lateral ocellus; face, including clypeus, longer than broad (17:14). Mesopleura moderately densely punctate, rather dull, finely sculptured between punctures, speculum more shining but entirely minutely sculptured; scutellum rather broad, sides of disk strongly margined except at apex by carinae which are more elevated and flaring opposite ends of scutellar groove; propodeum moderately elongate, median sulcus shallow, basal transverse carina short, lateral sections of apical carina usually distinct; spiracle elongate; sculpture of propodeum varying from finely roughened on basal angles, to weakly, irregularly, somewhat transversely rugulose, posteriorly; areolet rather small, intercubiti forming an acute angle; nervulus slightly post-furcal. Petiole without lateral impression or fovea before spiracle; second tergite elongate, spiracle at apical two-fifths, gastrocoeli elongate; third segment with black subintegumental line visible as far as spiracle.

Head including mandibles and antennae, thorax, propodeum, tegulae, legs except as noted below, first and second tergites except apex of latter, black; palpi brown, sheath of ovipositor brownish-black; veins and stigma brown; anterior surface of front femora and usually entire front tibia, yellow; front tarsi, middle tibia, base of hind tarsi, and hind calcaria, brownish-black; abdomen reddish except as noted above.

Male—Structure as in female. Differs in colour from female in the following respects: palpi, most of mandibles, tegulae except brown posterior margin, front legs except basal half of coxae, middle femora in front and at apex, middle tibia entirely, middle tarsi except apex, broad band extending almost to base of hind tibia, yellow.

The male differs in colour from the female in much the same manner as in *assita*.

Distribution—A rather common species in northeastern United States and the adjacent Canadian provinces. Examples are at hand from various localities in New York, Vermont, New Hampshire, Maine, Connecticut, Nova Scotia, Quebec, Ontario and Manitoba.

The species appears to prefer wooded areas. The writer once took a fine series in a patch of bracken fern on the edge of a woodlot at Knowlton, Que.

18. **Campoplegidea assita** (Nort.)

Plate II, Figs. 2, 6, 6*(a)*.

Campoplex assitus Norton, Proc. Ent. Soc. Phila., I, 367, 1863.
C. (Viereckiana) curvata Viereck, Trans. Roy. Soc. Can., XXI, Sec. V, 174, 179, 1926 (New synonymy).
C. (Viereckiana) citripes Viereck, Trans. Roy. Soc. Can., XXI, Sec. V, 174, 179, 1926 (New synonymy).

Type—The type of *assita* is a female in the Peabody Museum of Natural History, Yale University, New Haven, Conn.; the types of *curvata* Vier. and *citripes* Vier. are Nos. 1757 and 1759, respectively, in the Canadian National Collection.

Female—Agreeing with the description of *montrealensis* except in the following respects: mandibular lamina terminating distally in an abrupt truncation; eyes very large; face narrow, including clypeus, much longer than broad (22:14); areolet moderate in size; nervulus post-furcal by almost one-half its length.

Tegulae dark brown to black; sixth and following tergites usually largely black; front tarsi, occasionally middle femora anteriorly, and middle tibia, more yellowish than in *montrealensis*; hind tibia brownish above toward base.

Male—Structure as in female. Differs strikingly from female in colour as follows: entire front and middle legs yellow, except base of coxae; hind tibia yellow, apical fifth black; hind tarsi dull yellow, apices of segments more or less suffused with blackish; palpi, mandibles and tegulae yellow.

Distribution—Fairly common in the same general region as *montrealensis*, it appears to be associated with a *Vaccinium* type of flora. Examples have been studied from the following regions: Connecticut, New Jersey, Michigan, Nova Scotia, Quebec and Ontario.

19. **Campoplegidea nigritibialis** Vier.

C. (Viereckiana) nigritibialis Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 174, 178, 1926.

Type—Female, No. 1756 in Canadian National Collection, Ottawa.

Very similar to *laminata* and *insolita* but differing in having face parallel sided and as broad as long; differs further from *laminata* in the black tegulae and hind tibiae. In this species and the two following the occipital carina is not abnormally produced. *Nigritibialis* is the only member of the group known to occur west of the Cordillera.

Female—Length 11–12 mm. Temples moderately rounded, distinctly receding; malar space a little less than one-half basal width of mandible; occipital carina extending to base of mandible without joining hypostomal carina, curving toward eye in genal region thus narrowing gena; ocellocular space slightly less than diameter of lateral ocellus; face, including clypeus, as broad as long; inner margins of eyes parallel below antennae. Mesopleura scarcely sculptured between punctures; speculum shining, only minutely and faintly sculptured; scutellum broad and rather low, lateral carinae strong on sides near base; propodeum with a rather strong, longitudinal sulcus; basal transverse carina and lateral sections of apical transverse carina present; propodeum transversely rugulose beyond basal carina except in median sulcus; areolet rather oblique; nervulus postfurcal by about one-half its length. Petiole without impression or fovea laterally before spiracle; second tergite moderately short, spiracle at apical two-fifths, gastrocoeli round or broadly oval; third segment with black subintegumental line visible as far as spiracle.

Head including mandibles except tips, antennae, thorax, propodeum, all coxae, middle and hind trochanters and femora except tips of middle femora, hind tibiae and tarsi and sometimes middle tibiae and their tarsi also, first abdominal segment, second tergite at least at base, and sheath of ovipositor black; tegulae varying from dark brown to almost pure black; front trochanters blackish, more or less brown in front; front femora black except for yellow stripe in front and at tip; entire front tibia yellow; front tarsi varying from yellowish to brownish-black but always with two or three apical segments blackish; middle tibia more or less yellowish-brown; middle tarsi brownish to black; stigma and veins brown, membrane distinctly tinged with brown; apical tergites occasionally blackish above.

Distribution—The type of *nigritibialis* is from Victoria, B.C. In addition five females have been studied from the following localities. B.C.: Nanaimo Biological Station; WASH.: Forks (Clallam Co.) and Blue Mts.; CALIF.: Angora L., Tahoe.

20. **Campoplegidea laminata** n. sp.

Agreeing in the female with the accompanying description of *nigritibialis* except in the following respects.

Female—Length 12.5 mm. Temples weakly rounded, strongly receding; malar space one-third basal width of mandible; ocellocular space two-thirds diameter of lateral ocellus; face, including clypeus, a little longer than broad, narrowing slightly ventrally. Mesopleura finely sculptured between punctures; speculum finely sculptured, rather shining; areolet petiolate, scarcely oblique.

Mandibles yellow with base and teeth brownish; front coxae black, yellow spot at apex; remainder of front legs yellow, except brown apical segment of tarsus; middle femora brownish-black with a yellow stripe on apical half in front; middle tibiae and tarsi yellow, except apical two segments of tarsi which are brownish; hind tibia with extreme base and stripe behind on basal two-thirds pale yellow; hind tarsi brown in front, blackish behind; tegulae yellow; stigma yellowish-brown, veins brown, membrane tinged with brownish; third tergite with blackish triangle on crest at base.

Male—In structure very similar to female. Differs in colour in having the middle coxae with a large yellow spot below, middle basal trochanters yellow in front, and middle femora broadly yellow in front throughout their entire length; also the front femora are striped with brown behind, and the yellowish on the hind tibia almost forms an annulus on the basal half; all the tergites beyond the second have their crests more or less blackish.

Holotype—♀, Hull, Que., Aug. 16, 1894, (ex. Harrington Coll.); No. 4495 in the Canadian National Collection, Ottawa, Ont.

Allotype—♂, Sutton, Que., July 30, 1936, (G. S. Walley).

Paratypes—♂, McKellar (Ottawa), Ont., July 14, 1932, (E. Lester); ♂, Pt. Sydney, Ont., July 3, 1919, (N. K. Bigelow); ♂, Sweetsburg, Que., July 6, 1936, (G. S. Walley); ♀, Ste. Agathe des Monts, Que., Aug. 3, 1937, (G. S. Walley); ♂, (no locality data; ex. Harrington Coll.); ♂, Teulon, Man., July 17, 1923, (A. J. Hunter); ♀, (no locality data; ex. Guignard Coll.) (Blue label No. 236). All foregoing paratypes in the Canadian National Collection. The following paratypes are in the Collections of the United States National Museum: ♂, Texas (Belfrage); ♀, Douglas Lake, Mich., July, (C. H. Kennedy); ♀, Harrisburg, Pa.; ♀, Inglenook, Pa., June 20, 1909, (P. R. Myers); ♀, Oliverea (Catskills), N.Y., Sept. 3–8, 1918; ♀, Bear Mt., N.Y., Aug. 30, 1925, (F. M. Schott); ♀, Albany, N.Y., July 15, 1927, (N.Y. St. Coll.); ♀, Long Bch. (Long Isl.) N.Y., Aug. 2, 1925, (F. M. Schott, (in washup)); ♀, Norfolk, Conn., July 1917, (J. K. Lewis); ♀, Pleasant Valley (Litchfield Co.) Conn.; ♀, Saugus, Mass., July 23; ♀, Hampton, N.H., Aug. 3, 1919, (S. Albert Shaw).

21. **Campoplegidea insolita** n sp.

This species is very close to *laminata* and a further series may prove it is not distinct. At present, however, all specimens referred here differ from *laminata* in having the tegulae dark brown, and the middle tibiae with a brown or blackish stripe inwardly. In other respects they agree with the foregoing description of the female of *laminata*. The male is unknown.

Holotype—♀, Lacolle, Que., July 21, 1928, (G. H. Hammond); No. 4496 in the Canadian National Collection, Ottawa, Ont.

Paratypes—5 ♀♀, from the following localities: Sweetsburg, Que., July 7, 1936, (G. S. Walley); Trenton, Ont., July 21, 1907, (Evans); Macdiarmid, (Lake Nipigon), Ont. (2 specimens) July 11, Aug. 1, 1922, (N. K. Bigelow); Aweme, Man., Aug. 31, 1925, (R. D. Bird). Paratype in United States National Museum.

Group IV *(variabilis)*.

22. **Campoplegidea variabilis** (Frankl.)

Campoplex variabilis Franklin, Ent. News, XXVI, 356, 1915.

Type—In collection of Massachusetts Agricultural College, Amherst, Mass. Identification of this species is based on a male paratype in the United States National Museum and a series of specimens in the National Collection.

This species and the next following differ from all others here considered in having the genae, and occipital and hypostomal carinae modified as noted in the key. *Variabilis* in several respects resembles members of the preceding group but can be distinguished readily by the absence of the mandibular lamina characteristic of that group. It is easily distinguished from *varicoxa* by its larger size and the form of the propodeum with its regular, transverse rugulae. Franklin ascribes a certain amount of colour variation to this species, which is borne out at least in part by the series before me, though it appears possible that his series may have been mixed.

Female—Length 9–10 mm. Temples broadly rounded, strongly receding; malar space one-third basal width of mandible; ocellocular space almost equal to diameter of lateral ocellus; face, including clypeus, fully as broad as long; mandibles with a rather prominent flange; rim-like margin of antennal foramen slightly produced above with a few small rugulae radiating from the produced portion; small depression between antennae; genae and occipital and hypostomal carinae as described in key. Mesopleura feebly shining, punctures slightly confused in median portion, speculum and intervals between punctures finely sculptured; metapleura more or less rugulose anteriorly; scutellum rather narrow, convex, its disk with lateral margins carinate on basal two-thirds; propodeum rather shining and evenly, transversely rugulose medially, basal transverse carina distinct, median sulcus rather deep, sides of propodeum evenly rounding to dorsal surface; areolet rather small, petiolate; nervulus post-furcal by one-half its length. Petiole on either side before spiracle with a weak groove which ends anteriorly in a minute fovea; spiracle of second tergite a little beyond middle; gastrocoeli broadly oval.

Head, most of mandibles, thorax, tegulae, propodeum, first abdominal segment, basal half of second tergite, fifth tergite except at base and all segments beyond, coxae, trochanters, middle femora except apices and hind legs almost entirely, black; palpi reddish-brown; front femora blackish on basal half shading to reddish beyond; front tibiae and tarsi reddish, three apical tarsal segments suffused with brownish; middle femora reddish-brown at apices; middle tibiae blackish shading to reddish-brown on apical half of anterior surface; middle tarsi brownish-black; hind calcaria dark brown; abdomen reddish except as noted above; veins and stigma brown; membrane faintly tinged with brownish.

Male—Length 9–10.5 mm. Differing from female in colour as follows: mandibles and tegulae yellowish; front coxae black with yellowish apices; remainder of front legs, and middle legs on apical fourth of femora and beyond, except last three tarsal segments which are blackish, yellowish to pale stramineous; hind tibia varying from entirely black to black with an obscure yellowish-brown sub-basal area.

Distribution—The type locality is Wareham, Mass. Specimens are in the National Collection from N.S.: White Pt. Beach (Queens Co.); and QUE.: Kazubazua.

Hosts—Franklin reared the type material from *Epelis truncataria* var. *faxonii* Minot (*Ematurga amitaria* Gn.). Also reported by Schaeffner and Griswold (U.S.D.A. Misc. Publ. 188, 91, 1934) from *Synchlora rubrifrontaria* Pack.

23. **Campoplegidea varicoxa** Vier.

Plate II, Fig. 1.

C. (Viereckiana) varicoxa Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 174, 180, 1926.
C. (Viereckiana) reticulata Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 174, 181, 1926. (New synonymy).
Pseudocasinaria paenealia Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 182, 1926. (New synonymy).

Types—The types of *varicoxa*, *reticulata* and *paenealia* are Nos. 1761, 1763, and 1765, respectively, in the Canadian National Collection.

This species, like the preceding, is remarkable in having the hypostomal and occipital carinae, near their point of confluence, strongly produced, and the adjacent portion of the gena impressed, thus accentuating the height of the carinae and forming a small but rather deep cavity flanking the carinae. This character will serve to distinguish *varicoxa* from a number of species pertaining to the *subtilis* and *minor* groups which in other respects more or less resemble it. In *varicoxa* the inner ca'carium of the hind tibia is unusually long, being fully three-fourths as long as the basi-tarsus. The species is further characterized as follows.

Female—Length 7–8 mm. Temples rounded, rather strongly receding; malar space about one-third basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-half basal width of latter; ocellocular space equal to diameter of lateral ocellus. Mesopleura, especially speculum, rather shining with faint shagreening between punctures; disk of scutellum with lateral carinae, except at apex; propodeum rather short, its dorsal and lateral surfaces meeting somewhat angularly, sulcus broad and distinct, basal transverse carina short, apical transverse carina only visible laterally; surface of propodeum irregularly rugulose, with rugulae in median sulcus arranged transversely; areolet rather small, sessile, or with short petiole; nervulus post-furcal by less than one-half its length. Petiole without foveae; second abdominal tergite rather short, spiracle distinctly beyond middle, gastrocoeli rounded or broadly oval.

Head, thorax, propodeum, first abdominal segment, second tergite in basal half or more, and last three tergites more or less, black; mandibles blackish at base; palpi pale reddish; coxae, trochanters, middle femora except apices, and hind legs except sometimes a streak on tibia, black; occasionally middle and hind femora rufo-piceous; front femora and apices of middle femora reddish; front and middle tibia and tarsi yellowish to pale reddish, middle tarsi with apices more or less blackish; tegulae yellow to brownish; stigma and veins dark brown, membrane faintly brownish.

Male—Propodeum a little more coarsely sculptured than in female; otherwise very similar. Colour as in female.

Notes—The amount of black on the apical tergites of the abdomen is variable. In three females studied the apical tergites are largely reddish while in others the black occupies all, or nearly all, of the fifth and following tergites. In one specimen (type of *reticulata*) the hind tibial stripe is particularly conspicuous.

Distribution—The types of *varicoxa* and *paenealia* are from Sudbury, Ont. and the type of *reticulata* is from Royal Oak, B.C. In addition three males and six females are at hand from the following localities. Que.: Kazubazua; Ont.: Lake Nipigon, Moosonee, Ottawa; Alta.: Edmonton; N.H.: Hampton; Pa.: Mt. Holly; Md.: Glen Echo.

Group V *(laticincta).*

Moderately large species (length 11–12 mm.); head rather thick antero-posteriorly; temples slightly to moderately receding; malar space broad, one-half to three-fifths basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-half basal width of latter; scutellum rather narrow; dorsal and lateral surfaces of propodeum meeting rather angularly; vestiture rather long and conspicuous; abdomen contrastingly red and black, the red confined to the median segments and the apical black portion unusually broad.

The two species placed in this group differ remarkably, in the female, in the length of the ovipositor and sheath. Both sexes may be distinguished by the differences in the form of the propodeum noted in the key.

24. **Campoplegidea laticincta** (Cress.)

Plate I, Fig. 6.

Campoplex laticinctus Cresson, Proc. Ent. Soc. Phila., IV, 283, 1865.
Campoplex nigripes Provancher, Le Nat. Can., VI, 145, 1874.
Campoplex laticinctus (= *nigripes* Provancher), Pet. Faun. Ent. Can. Hymen., 111, 362, 1883.
Campoplegidea brooksi Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 261, 264, 1925. (New synonymy).

Types—The type of *laticincta* is a female, from Colorado, No. 1554 in the Academy of Natural Sciences, Philadelphia; that of *brooksi* is a male from Manitoba, No. 1359 in the Canadian National Collection. The type of *nigripes* has not been located but may be one of the specimens placed under *laticincta* in the Provancher Collection at Quebec, as has been suggested by Gahan and Rohwer (Can. Ent., XLIX, 335, 1917). This seems quite probable since Provancher himself proposed the synonymy. All specimens of *laticincta* now in the Provancher collection have been examined and found to be correctly determined.

This species is unusual in having the propodeum without a distinct longitudinal sulcus, the dorsal region being flat or only very broadly and feebly depressed.

The following descriptive notes are drawn from a series of specimens from Colorado, including a homotype (Gahan, 1920) of *laticincta*.

Female—Length 11–12 mm. Temples broad, only slightly receding for some distance behind eyes, then strongly rounded to occiput; malar space three-fifths basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-half basal width of latter; ocellocular space fully as broad as diameter of lateral ocellus. Mesopleura shining, rather coarsely, densely punctate, intervals between punctures without sculpture, speculum finely rugulose; scutellum small and rather narrow, disk evenly, densely punctate, with lateral carinae distinct almost to apex; lateral portions of prepectoral carina absent, median portion joined with the strongly elevated margin of coxal scrobe; apex of propodeum scarcely attaining middle of dorsal surface of hind coxa; dorsal surface of propodeum flat or very broadly and shallowly concave, basal transverse carina distinct at middle, apical transverse carina present only laterally; propodeum with numerous, somewhat irregular, transverse rugulae, most prominent on lateral surfaces and along middle; areolet

large, rather broad, petiole short; nervulus post-furcal by one-half its length; longer calcarium of hind tibia one-half as long as basi-tarsus; claws strongly pectinate almost to apex. Petiole without lateral fovea, sometimes with a very faint, elongate impression; spiracle slightly before apical two-fifths of second tergite; gastrocoeli oval; sheath short.

Head, thorax and propodeum black; abdomen red, with first segment entirely, second tergite except narrow apex, and beyond base of fifth segment, black; sheath black; mandibles blackish, more or less yellow on upper median portion; palpi blackish; legs black, front coxae and trochanters sometimes with a small yellow spot in front, front femora and tibia pale brownish-yellow in front, middle tibia also somewhat brownish on inner surface, sometimes the front tibia and tarsi dark brownish posteriorly; tegulae black; veins and stigma dark brownish-black; membrane slightly dusky; head and thorax with conspicuous, whitish vestiture.

Male—Differing from female in colour as follows: front coxae and trochanters yellowish anteriorly; front femora and tibia more extensively and conspicuously yellow, the middle femora at apex and middle tibia along anterior surface also yellowish.

Host—A single male, without locality data, in the collection of the United States National Museum bears the data "Parasite on *Heliothis* (Miss Murtfeldt)".

Distribution—Fifty-three specimens of this species have been studied from the following localities. N.Y.: Flatbush; N.J.: Palisades; Pa.: Highspire; Vt.: Jay; Ohio: Put-in-Bay; Minn.: (no locality); Colo.: (Baker Coll., no locality); Mont.: Bozeman Pass (6700 ft.); Ore.: Corvallis; Calif.: Summit (Placer Co., 7000 ft.); Que.: Aylmer, Montreal; Ont.: Macdiarmid (L. Nipigon), Mer Bleue (near Ottawa), Moosonee, Smoky Falls (Mattagami R.), Sudbury; Man.: Aweme, Transcona (type of *brooksi*); Sask.: Radison, Saskatoon; Alta.: Bilby, Calgary, Edmonton, Waterton.

Remarks—Specimens in the above series vary considerably in the form of the prepectoral carina and the margin of the coxal scrobe, and employing such characters it may be possible to recognize two geographical races. In some specimens the lateral portions of the prepectoral carina are entirely lacking and the median portion is continuous with the strongly elevated margin of the coxal scrobe; the latter margin is somewhat recessed above, thus accentuating its flange-like nature. This condition pertains in specimens from Colorado, California, Montana, Oregon and British Columbia. In other specimens from New Jersey, Pennsylvania, Vermont, Ohio, Minnesota, Quebec and Manitoba (holotype of *brooksi*) the lateral portions of the prepectoral carina are well defined above the point where the margin of the coxal scrobe joins the prepectoral carina. Difficulty arises when an attempt is made to place certain specimens from northern Ontario, Saskatchewan and Alberta in the above categories, there being a range of variation (sometimes in specimens from the same locality) from a condition in which the lateral portions of the prepectoral carina are well defined to one in which they are entirely absent. There is also variation in the extent of puncturation on the lower portion of the prepectus adjoining the coxal scrobe.

25. **Campoplegidea caudata** n. sp.

Plate III, Fig. 8.

Resembles *laticincta*, with which it has been confused in collections, but differing from that species in having the propodeum with a distinct longitudinal sulcus, the temples moderately receding, and in the female by having the sheath as long as the sclerotized portion of the first abdominal sternite. From descriptions this species appears to be close to *C. lapponica* (Holmg.) of Europe.

Female—Length 11.5 mm. Temples evenly rounded, moderately receding; malar space one-half basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-half basal width of latter; ocellocular space nearly equal to diameter of lateral ocellus. Mesopleural punctures dense and somewhat confused; mesopleura more or less regulose above and with a band of confused, confluent punctures extending between speculum and prepectus; lateral portions of prepectoral carina obsolete, the well defined median portion joined with the elevated margin of coxal scrobe; propodeum resembling *laticincta* but with a distinct median longitudinal sulcus; wings as in *laticincta*. Petiole without fovea; gastrocoeli elongate; ovipositor unusually long and broad; sheath as described above.

Colour as in *laticincta*.

Male—Structurally as in female; colour as in male of *laticincta*.

Holotype—♀, Ste. Agathe des Monts, Que., Aug. 7, 1937, (G. S. Walley); No. 4497 in the Canadian National Collection, Ottawa, Ont.

Allotype ♂, same locality as holotype, Aug. 4.

Paratypes—3 ♀♀, from holotype locality Aug. 4–7, 1937, (G. S. Walley); 3 ♀♀, Lac Mercier, Que., Aug. 15, 17, 1937, (G. S. Walley); ♀, Laniel, Que., Aug. 15, 1933, (H. Fleming); 2 ♂♂, Cascapedia R. (Kelly's Camp), Gaspé, Que., July 8, 1933, (W. A. Reeks), Exp. No. 18772-10B.

Host—The two males from Cascapedia R. were reared from *Eulype hastata gothicata* Gn.

Notes—In addition to the type series the following specimens have been studied: ♂, Macdiarmid (L. Nipigon) Ont., July 6, 1923, (N. K. Bigelow); ♂, Wabamun, Alta., July 31, 1929, (E. H. Strickland); ♀, Hampton, N.H., Sept. 3, 1911, (S. Albert Shaw); ♀, Kodiak, Alaska, July 20, 1899, (T. Kincaid); ♂, Popoff Isl., Alaska, July 12, 1899, (T. Kincaid); ♂, Kukak Bay, Alaska, July 4, 1899, (T. Kincaid). A number of these specimens differ slightly from the types in details of colour and structure but with the material at hand the differences do not appear to be sufficiently pronounced to warrant the recognition of more than one species.

Group VI *(pectoralis)*.

26. **Campoplegidea pectoralis** n. sp.

Plate III, Fig. 7.

This species, the sole representative of the group, is unique in the combination of characters given in the key. It cannot be related with certainty to any other group here dealt with. The form of the prepectoral

carina and the elevated margin of the coxal scrobe, also the very shallowly sulcate propodeum suggest affinities with *laticincta*, while the petiolar groove is somewhat as in *variabilis*. The rather large areolet and well defined, recurved, basal propodeal carina are reminiscent of the last four or five groups in the genus.

Female—Length 10 mm. Temples very weekly curved, strongly receding; malar space one-third basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-half basal width of latter; hypostomal carina distinctly more elevated than occipital carina; ocellocular space about three-fourths diameter of lateral ocellus; frons with a distinct, median, vertical carina. Mesopleural punctures large, rather dense, intervals between punctures shining and without sculpture; speculum finely rugulose; prepectoral carina distinct only in median portion, laterally continuous with the strongly elevated margins of coxal scrobes, the latter flanked above by a narrow but deep recess; scutellum rather small, convex, disk on basal half margined by carinae; sides of scutellum sparsely hairy; propodeum narrow, dorsal surface evenly rounded to sides, median longitudinal sulcus broad and very shallow; basal transverse propodeal carina distinct with apices curving forward to almost attain spiracles; lateral portions of apical carina present; areolet large, broad; second recurrent nearly straight; nervulus post-furcal by two-thirds its length. Petiole with a shallow groove on either side before spiracle; second tergite about four times as long as broad at apex, spiracle at apical two-fifths; subintegumental line on third segment distinct; sheath slender, rounded at apex.

Head, thorax, propodeum, first abdominal segment, second tergite except postero-lateral portions and crest of third tergite, black; palpi and middle of mandible yellowish; tegulae yellowish in front, brownish behind; legs black, paler as follows: spot at apex of front coxae, anterior surface of front trochanters and femora; front tarsi except last segment, apices of middle femora, middle tibiae and three basal segments of middle tarsi, yellowish; front trochanters and front femora (except as noted above) brownish-stramineous; apical segments of front and middle tarsi pale brownish; hind tibia and tarsi dark brownish-black, the tibia somewhat paler behind on basal two-thirds; posterior calcaria pale brown. Stigma and veins brown, membrane with a faint brownish tinge; abdominal tergites reddish (except as noted above); plica of first two segments yellowish; sheath black.

Holotype—♀, Lac Mercier, Que., Aug. 17, 1937, (G. S. Walley); No. 4498 in the Canadian National Collection, Ottawa, Ont.

Paratypes—♀, Lac Mercier, Que., Aug. 16, 1937, (G. S. Walley); ♀, Ottawa, Ont., Aug. 5, 1894, (W. Harrington); 2 ♀♀, Waskesiu Lake, Sask., Aug. 1, 1939, (A. R. Brooks); ♀, Edmonton, Alta., July 16, 1932 (O. Peck); ♀, Whitemud River (Peace River District) Alta., July 19, 1932, (L. S. Russell). Paratype in United States National Museum.

Group VII *(minor)*.

The four species which follow are all small forms (length 6–7 mm.), characterized by having the humeral angles of the pronotum prominently projecting laterally before the tegulae. This character is most conspicuous

when the thorax is viewed from a dorsal aspect. It serves to distinguish members of the *minor* group from a number of otherwise rather similar species of the succeeding group. The *minor* group is further noteworthy in having the propodeal spiracles small and usually short-oval in form, the petiole with a small fovea on either side before the spiracle, the propodeal sulcus broad and rather shallow, and the lateral portions of the basal, transverse, propodeal carina strongly divergent.

The species in this group are not strongly characterized and the distinctions, largely those of colour, may not prove entirely reliable when larger series of specimens are available for study.

27. **Campoplegidea minor** Prov.

Plate II, Fig. 5.

Campoplex minor Provancher, Pet. Faun. Ent. Can. Hymen., II, 364, 1883.
Pseudocasinaria decorata Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 182, 183, 1926. (New synonymy).

Types—Type of *minor* is a female, No. 293 in the Quebec Public Museum; that of *decorata* is a male, No. 1764 in the Canadian National Collection.

Female—Length 6–7 mm. Temples moderately curved, rather strongly receding; malar space slightly less than one-half basal width of mandible; occipital carina extending to base of mandible; gena rather narrow; ocellocular space slightly less than diameter of lateral ocellus; face, including clypeus, scarcely longer than broad. Mesopleura dullish, finely punctate; speculum somewhat shining and finely sculptured; prepectoral carina extending well above level of base of coxa; disk of scutellum margined laterally by carinae except at apex; propodeal sulcus broad, very shallow; basal transverse carina of propodeum distinct, with its lateral arms strongly diverging; propodeum irregularly, rather coarsely rugulose, the rugulae transverse in region of sulcus; areolet rather small; nervulus slightly post-furcal. Petiolar foveae distinct and often rather deep; spiracle of second tergite distinctly beyond middle; gastrocoeli small, elongate-oval.

Head, thorax, propodeum, first abdominal segment, second tergite except apex and coxae except spot on anterior pair, blackish; mandibles, palpi and tegulae yellowish to stramineous; middle and hind trochanters more or less blackish, legs otherwise largely reddish; front and middle tibiae and tarsi paler reddish, hind tibia varying from almost entirely reddish to dark reddish, with the base narrowly and the apex more broadly suffused with blackish; hind tarsi blackish except at base; wings faintly dusky, veins and stigma brown; abdomen reddish beyond apex of second tergite, occasionally with the crest of apical tergites blackish; sheath blackish.

Male—Differs principally from the female in having the front and middle coxae blackish only at extreme base; hind coxae also more or less marked with darker reddish.

Distribution—The type of *minor* is from Quebec; that of *decorata* from Ottawa, Ont. In addition the writer has studied twenty-three specimens from the following localities. Va.: Dixie Landing; Md.: Cabin John; Que.: Cascapedia, Knowlton, Lac Mercier, Ste. Agathe des Monts; Ont.: Lake Nipigon, Smoky Falls (Mattagami R.), Ottawa; Alta.: Edmonton; B.C.: Jesmond.

28. **Campoplegidea mitis** n. sp.

Exceedingly similar to *minor* and perhaps only a variety of that species.

Female—Length 7 mm. Malar space slightly broader than in *minor*.

Tegulae blackish; abdomen with most of fifth and the following tergites entirely black; colour otherwise as in description of *minor*.

Holotype—♀, Wright, Que., June 28, 1935, (G. S. Walley); No. 4499 in the Canadian National Collection, Ottawa, Ont.

Paratypes—2 ♀♀, from Harrington Collection (no locality given); ♀, Bartonsville, Monroe Co., Pa., May 26, 1917.

Last paratype in Collection of United States National Museum.

29. **Campoplegidea pacifica** (Vier.)

Amorphota pacifica Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 185, 186, 1926.

Type—Male, No. 1767 in the Canadian National Collection, Ottawa, Ont.

Differs from *minor* and *mitis* in having the hind femora blackish and from the former in having the abdomen broadly black at apex. Structure very similar to *minor*. Differs from *maritima* in having the abdomen black at apex.

This species was described from a single male from Victoria, B.C. A female from Bozeman, Mont. (Bozeman Pass, elev. 6700 ft.) agrees very well with the type as does also a male from Kaslo, B.C. In these three specimens the tegulae are bicoloured, yellow in front and brownish on the posterior half. Three females from Colorado and one from Hope Mts., B.C. (elev. 4500 ft.) agree with the above but have the tegulae uniformly brownish. A single male bearing the data, "Virgin's Bay, Alaska, June 26, 1899 (Harriman Expedition 1899, T. Kincaid Coll.)" has the tegulae dark brown, the propodeum a little more coarsely sculptured and the petiolar fovea weakly defined; otherwise it agrees with the above series.

The following species from Eastern Canada is also closely allied to *pacifica*.

30. **Campoplegidea maritima** n. sp.

Female—Length 6 mm. Malar space one-half basal width of mandible; face, including clypeus, one-fourth longer than broad; propodeum rather finely, irregularly rugulose, rugulae transverse in region of sulcus.

Second tergite black except extreme apex; mandibles black; palpi and tegulae dark brownish-black; all coxae, trochanters, middle femora except apices and hind femora, black; front femora reddish-brown shaded with fuscous at base; front tibiae and tarsi yellowish-brown to stramineous, paler outwardly, apical segment of tarsus blackish; middle tibiae and tarsi mostly brownish; hind tibiae dark brown with narrow base and broader apex, blackish; hind tarsi blackish; three apical tergites of abdomen each with a small dusky spot at crest.

Structure and colour otherwise as in description of *decorata*.

Holotype—♀, White Pt. Beach (Queens Co.), N.S., Aug. 17, 1936, (J. McDunnough); No. 4500 in the Canadian National Collection, Ottawa, Ont.

Paratype—♀, Ste. Agathe des Monts, Que., Aug. 4, 1937, (G.S. Walley).

Group VIII *(subtilis)*.

The fourteen species which follow agree in having the mesopleura (except sometimes the speculum) only feebly shining or opaque. Its surface is moderately to rather densely punctate with the spaces between punctures finely but distinctly sculptured. In *glauca*, *caliginosa*, *diversicolor*, *vicina*, *seamansi*, *bicoloripes*, *rotunda* and *fossata* the petiole bears a distinct, circular fovea on either side before the spiracle. In *glauca* and *caliginosa* the fovea is sometimes close to the spiracle as in the *diversa* group. In *crassicornis*, *subtilis*, *nigrofasciata*, *grahami*, *woodi*, and *americana* the fovea is represented by a poorly defined, shallow impression which in occasional specimens may be almost wanting.

Woodi and *americana* are undoubtedly closely allied, as is also perhaps *fossata*, though this latter species has a rather distinct petiolar fovea. These three species approach *gracilis* of the succeeding group.

The group is not a compact one and may be susceptible to further subdivision.

31. **Campoplegidea subtilis** Vier.

C. (Viereckiana) subtilis Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 173, 176, 1926.

Type—Female from Banff, Alta., No. 1752 in the Canadian National Collection.

The humeral angles of the pronotum do not project in this species, otherwise it resembles the preceding group of species, particularly *pacifica*. In the present group it is easily distinguished by the small, rather broadly oval propodeal spiracles, the unusually broad malar space, scarcely receding temples, broad ocellocular space and the relatively narrow, reddish band on the abdomen.

The type, which is the only known specimen, is redescribed as follows.

Female—Length 7 mm. Temples broad, scarcely receding, rounded behind; malar space two-thirds basal width of mandible; occipital carina terminating close to base of mandible, weakly defined near point of junction with the stronger hypostomal carina; ocellocular space one and one-third times diameter of lateral ocellus. Mesopleura feebly shining, punctate, speculum and spaces between punctures sculptured; disk of scutellum margined by carinae on basal half; propodeal sulcus distinct; basal transverse propodeal carina short and weak; propodeal spiracles small, oval; areolet sessile, second recurrent received beyond middle; nervulus postfurcal by almost half its length. Petiolar fovea indistinct, represented by a minute punctiform impression; second tergite short, less than twice as long as high (viewed in lateral aspect) at apex, spiracle slightly beyond middle, gastrocoeli rounded.

Black; abdomen with apex of second and entire third tergite reddish; mandibles black with a preapical yellowish band; palpi dark brown; tegulae black; legs black, front femora except at base, front tibia and tarsi, apex of middle femora, middle tibia entirely and hind tibia except at apices, pale reddish-brown; middle tarsi largely dark brown, two basal segments paler at base; hind tarsi dark brown, paler at bases of segments; hind calcaria yellowish-brown.

32. **Campoplegidea crassicornis** (Prov.)

Limneria crassicornis Provancher, Add. Faun. Ent. Can. Hymen., p. 88, 1886.
Campoplegidea crassata Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 262, 267, 1925. (New synonymy).
C. (Viereckiana) mimetica Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 173, 175. (New synonymy).
C. (Viereckiana) sessilis Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 174, 179, 1926. (New synonymy).
C. (Viereckiana) flavicoxa Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 174, 180, 1926. (New synonymy).

Types—The type of *crassicornis* is a male, No. 1222 in the Quebec Public Museum, Quebec. The types of *crassata*, *mimetica*, *sessilis* and *flavicoxa* are Nos. 1397, 1751, 1758, and 1760, respectively, in the Canadian National Collection, Ottawa, Ont.

The types of the above mentioned species have been examined and the writer would regard them all as pertaining to one species. As noted elsewhere, the allotype of *mimetica* is a typical male of *montrealensis*.

This is a small species, rather variable in colour and most easily identified by the strongly carinate lateral margins of the disk of the scutellum. The scutellum is broad, feebly convex, usually without distinct punctures and the carinae extend almost to the apex of the disk and are strongly elevated throughout their length. A few other small species falling in this section of the genus have the scutellum more or less carinately margined. From these *crassicornis* may be further distinguished by the differences in form of temples, length of second tergite, sculpture of propodeum and colour of hind femora and abdomen.

Female—Length 7–8 mm. Temples rounded, moderately receding; malar space scarcely one-third basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-third to one-fourth basal width of latter; ocellocular space slightly less than diameter of lateral ocellus; mesopleura mat, with fine, well separated punctures; basal transverse carina of propodeum distinct, at middle rather broadly transverse, its lateral arms rather strongly diverging; apical transverse carina indistinct; median longitudinal sulcus of propodeum broad, more or less transversely rugulose; areolet moderate to small, petiolate, recurrent received at about middle and forming an obtuse angle, inwardly, with subdiscoideus; nervulus post-furcal by a little more than one-half its length. Petiole without fovea but usually with a slight impression on either side before spiracle; second tergite moderately long, spiracle at apical two-thirds, gastrocoeli elongate.

Head, thorax, propodeum, first abdominal segment, basal three-fourths of second tergite, apical two or three tergites, sheath, all coxae, trochanters, middle and hind femora except apex of former, black; entire front and apex of middle femora reddish; front and middle tibiae and tarsi yellowish-stramineous; hind tibiae and tarsi blackish, former streaked with brownish on basal two-thirds, latter narrowly pale brown at base of first segment; abdominal tergites reddish except as noted above; veins and stigma dark brown, membrane faintly brownish; tegulae dark brown.

Male—Propodeum usually more coarsely sculptured than in female, apical carina distinct and frequently extending forward on either side of median sulcus to sometimes attain lateral arms of basal carina.

Front and middle coxae yellowish on apical half; front and middle trochanters entirely yellow; middle femora mostly pale reddish, sometimes with a brown suffusion behind; hind tibia with a broad, sordid yellowish annulus on basal two-thirds, the annulus sometimes more or less obscured by a brownish suffusion; tegulae yellow.

Distribution—The type of *crassicornis* is from Cap Rouge, Que.; the types of *crassata*, *sessilis* and *flavicoxa* are all from the Montreal, Que., region; the type of *mimetica* is from the vicinity of Ottawa, Ontario.

In addition to the types, twenty specimens have been studied from the following localities: N.Y.: Ithaca; OHIO: Sandusky; WISC.: Polk Co.; N.B.: Fredericton; QUE.: Brome, Georgeville, St. Johns; ONT.: Lobo, Pt. Pelee; ALTA.: Edmonton.

33. **Campoplegidea glauca** (Nort.)

Campoplex glaucus Norton, Proc. Ent. Soc. Phila., I, 366, 1863.
Campoplegidea rossi Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 261, 268, 1925. (New synonymy).

Types—Type of *glauca* is a female (headless) in Peabody Museum of Natural History, Yale University; that of *rossi* is No. 611 in Canadian National Collection.

Identification of this species is based on a homotype (Gahan 1920) of *glauca* in the United States National Museum.

This species and *caliginosa* agree in the following respects: occipital and hypostomal carinae uniting distinctly before the base of mandible, temples rather flat and strongly receding, apical carina of propodeum extending far forward on either side of median sulcus, petiole with a distinct fovea on either side before spiracle.

Glauca differs from *caliginosa* as noted in the key and in the discussion under the latter species.

Female—Length 8–10 mm. Temples feebly curved, strongly receding; junction of occipital and hypostomal carinae distant from base of mandible one-half to three-fourths basal width of latter; ocellocular space slightly less than diameter of lateral ocellus. Thorax dull, mesopleura densely punctate, mat; propodeum with median sulcus broad, shallow; basal transverse propodeal carina distinct, apical transverse carina extending far forward on either side of median sulcus; areolet narrow, petiolate, intercubiti forming an acute angle; nervulus post-furcal by about one-half its length. Petiolar foveae moderately large, sometimes as close to spiracle as distance between spiracles; second tergite moderately long, its spiracle distinctly beyond middle.

Head, thorax and propodeum black; scape more or less brown below, flagellum sometimes brownish apically; tegulae yellowish or somewhat brown; petiole black, sometimes with reddish below and on sides; postpetiole reddish at apex and laterally, sometimes entirely reddish. Front legs, except coxae, mostly yellowish; middle femora pale reddish, sometimes blackish at base; middle tibia and tarsi yellowish.

Male—Very similar to female; occasionally the crest of the apical tergites is streaked with blackish.

The specimens of this species at hand vary somewhat in colour. In the palest examples the hind legs, including the coxae, also the post-petiole and more or less of the petiole are reddish. Darker examples have the hind coxae black, the hind femora rufo-piceous and the petiole and post-petiole, except the apex of the latter, black.

Distribution—ME.: N. E. Harbour, Salisbury Cove; MD.: Plummers Isd.; N.H.: Canobie Lake; KAN.: Lawrence (Homotype of *glauca*); QUE.: Cascapedia; ONT.: Jordan, Leamington, Macdiarmid (L. Nipigon).

Host—The specimen from Canobie Lake, N.H. was reared from [*Petrophora*] *Lygris divisilineata* Hbn.

34. **Campoplegidea caliginosa** n. sp.

Resembles *glauca* closely in structure, The black tegulae, middle and hind femora, entire first abdominal segment and three or four apical tergites will at once distinguish *caliginosa* from that species.

Female—Length 10 mm. Temples feebly curved, strongly receding; Malar space one-half basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible three-fourths basal width of latter; ocellocular space almost equal to diameter of lateral ocellus. Thorax dull, mesopleura densely punctate, mat, speculum shagreened and finely rugulose; scutellum dull, feebly convex, disk with weak lateral carinae except near apex; propodeum dullish, coriaceous, with fine rugulae; basal and apical transverse propodeal carinae distinct, latter extending far forward on either side of median sulcus; apex of propodeum with a short stub of a median, longitudinal carina; propodeal spiracle about three times as long as broad; areolet petiolate, intercubiti forming a moderately acute angle, recurrent received very slightly beyond middle; nervulus postfurcal by one-half its length. Petiolar fovea large, about as far in front of spiracle as distance between spiracles; spiracle of second tergite at apical two-fifths.

Head including mandibles and antennae, thorax, propodeum, tegulae, coxae, trochanters, posterior surface of front femora, middle and hind femora, first abdominal segment, second tergite except apex and laterally beyond spiracles, four apical tergites and sheath, black; palpi dark brownish-black; front tibiae and tarsi and stripe on front femora, stramineous; middle tibiae and tarsi yellowish-brown with blackish suffusion above; hind tibiae and tarsi brownish-black, former with a paler brownish streak, on basal two-thirds, above; stigma and veins dark brownish-black, membrane faintly brownish.

Holotype—♀, Steelhead, B.C., July 20, 1933, (H. B. Leech); No. 4501 in the Canadian National Collection, Ottawa, Ont.

Paratypes—♀, Jordan Meadows, B.C., July 12, 1928, (W. Downes); ♀, Likely, B.C., July 9, 1938, (G. S Walley); ♀, 100 Mile House, B.C., July 4, 1938, (G. S. Walley); ♀, Gull Lake, Alta., June 8, 1929, (E. H. Strickland); ♀, Yachats, Ore., April 27, 1930, (J. Wilcox).

Paratypes in collections of University of Alberta, Edmonton, Alta. and United States National Museum.

No males are at hand from the type locality but a single specimen in the United States National Museum bearing the data, "Virgins Bay, Alaska, June 26, 1899. Harriman Expedition 1899, T. Kincaid Collector" is, I believe, correctly referred to this species. The legs are somewhat paler in colour, probably partly owing to the age of the specimen.

35. **Campoplegidea diversicolor** Vier.

Plate I, Fig. 7; Plate II, Fig. 4.

Campoplegidea diversicolor Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 262, 265, 1925.

Type—A female from Sudbury, Ont., No. 1398 in the Canadian National Collection.

In many respects similar to *vicina*, which also has the mesoscutal carina high opposite the scutellar groove but not terminating in a lobe as in the present species. Differs from *seamansi*, *bicoloripes* and *rotunda* in the more strongly receding temples, and from the latter, as well as *glauca* and *caliginosa*, in having the occipital and hypostomal carinae not uniting before base of mandible. Distinct from all species in the present group in having the extreme base of the lateral margin of the third abdominal tergite sharply inflexed.

Female—Length 9 mm. Temples weakly curved, strongly receding; malar space slightly more than one-third basal width of mandible; occipital and hypostomal carinae not uniting before base of mandible; ocellocular space about three-fourths diameter of lateral ocellus; front depressed, with fine, median, vertical carina. Mesopleura finely punctate, mat, speculum entirely minutely sculptured; mesoscutum and scutellum densely, shallowly punctate, mat; mesonotal carina (viewed laterally) terminating in a prominent lobe opposite basal angle of scutellum; apex of propodeum scarcely attaining middle of dorsal surface of hind coxae; basal transverse carina distinct, apical carina extending far forward on either side of the broad, median, longitudinal sulcus; areolet small, narrow, second recurrent received before middle; nervulus slightly post-furcal; inner calcarium of hind tibia four-fifths as long as basi-tarsus. Petiole with distinct lateral fovea; second tergite only moderately long, spiracle distinctly beyond middle; third tergite with lateral margin broadly, concavely arcuate, inflexed at extreme base.

Head, thorax, propodeum, first segment of abdomen, greater part of basal half of second tergite, black; mandibles yellowish, black at base, teeth brown; palpi pale yellowish-brown; tegulae yellow; legs black; front coxae pale at apex, front trochanters and base of femora brownish, the latter shading to yellowish apically and in front; remainder of front legs, also apices of middle femora and beyond, yellowish to brownish, the middle tibia with a brownish stripe below and the middle tarsi pale brown; hind legs black, except for an obscure brownish stripe on tibia near base, calcaria sordid yellowish; veins and stigma brown, membrane faintly brownish; post-petiole with apex somewhat reddish, abdomen reddish beyond middle of second tergite; sheath brown.

Known only from the type and a female from Knowlton, Que., July 11, 1929 (G. S. Walley).

36. **Campoplegidea vicina** (Prov.)

Campoplex vicinus Provancher, Nat. Can., VI, 145, 1874.
Campoplex relectum Davis, Trans. Am. Ent. Soc., XXIV, 361, 1897. (New synonymy).

Types—The type of *vicina* is a female, bearing yellow label, No. 291, in the Quebec Public Museum, Quebec. The type of *relectum* is a female, No. 4471, in the Academy of Natural Sciences, Philadelphia. The latter has not been studied by the writer but from the notes obtained on it by Messrs. Brown and Peck I feel certain the above synonymy is correct.

In addition to the type of *vicina*, four males and three females of this species have been studied by the writer. The following description is drawn from these latter specimens, one of which was compared with the type and found to agree very exactly.

Female—Length 8.5 mm. Temples moderately receding; malar space nearly one-third basal width of mandible; occipital carina extending to base of mandible without joining hypostomal carina, somewhat outcurved below so that gena is narrowed; ocellocular space a little less than diameter of lateral ocellus. Mesopleura finely punctate, mat, speculum feebly shining but entirely sculptured; mesonotal carina high opposite scutellar groove; scutellum unusually short and broad, disk margined laterally by carinae almost to apex; propodeum rather narrow, elongate, median sulcus broad, basal and sometimes oblique portions of apical carina present; areolet of moderate size, second recurrent received at or slightly beyond middle, inwardly forming a slightly obtuse angle with subdiscoideus; nervulus post-furcal by fully one-half its length. Petiole with a minute fovea on either side far in front of spiracle; second tergite only moderately long, spiracle distinctly beyond middle.

Head, thorax, propodeum, first abdominal segment, basal two-thirds of second tergite, sheath, coxae, middle and hind trochanters, middle femora except at apex, hind femora entirely, hind tibiae except a pale brownish streak on either side on basal two-thirds, hind tarsi except narrowly at base, black; palpi dark brown; front femora stramineous in front and apically, brownish behind; front tibia and tarsi and middle tibia yellowish-stramineous; middle tarsi dark brown; tegulae yellowish-brown, paler in front; veins and stigma dark brown; membrane faintly brownish; abdomen reddish except as noted above.

Male—Very similar to female. One specimen has the apical carina of propodeum distinct on either side of median sulcus.

Differs in colour from female in having the front and middle trochanters and femora pale reddish and their tibia and tarsi yellowish-stramineous; palpi reddish; mandibles, except tips, yellowish; sixth and seventh abdominal tergites with a small black spot at the crest.

Hosts—*Semiothisa sexmaculata* Pack., *Semiothisa* sp.

Distribution—Que.: Aylmer, Brome, St. Michel; Ont.: Ottawa, Macdiarmid (L. Nipigon). Provancher's type presumably was taken in Quebec; the type of *relectum* is from Franconia, N. H.

37. **Campoplegidea seamansi** Vier.

Plate II, Fig. 9.

Campoplegidea seamansi Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 262, 268, 1925.
Campoplegidea edmontonensis Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 262, 266, 1925. (New synonymy).

Types—The type of *seamansi* is No. 1405 and *edmontonensis* No. 1400 in the Canadian National Collection, Ottawa, Ont.

This species is known only from the two above type specimens. These present many structual features in common, and since the colour differences are the usual ones associated with sex, it is believed they pertain to one species. *Seamansi* is selected as the valid name for the species since it is based on the female and has priority in Viereck's key.

This species is very similar to *bicoloripes* and there are no good structural characters to distinguish them.

Female—Length 9 mm. Temples wider than usual and broadly rounded to occiput, only slightly receding; malar space approximately two-fifths basal width of mandible; occipital carina extending to base of mandible without uniting with hypostomal carina; ocellocular space equal to diameter of lateral ocellus; face, including clypeus, fully as broad as long. Mesopleura feebly shining, punctures of moderate size and fairly dense, spaces between punctures finely sculptured, speculum more shining, with a small polished area, but mostly with faint sculpture; disk of scutellum with lateral margins with low carina nearly to apex; propodeal sulcus broad; basal propodeal carina rather strong, lateral arms strongly diverging; dorsal and lateral surfaces of propodeum meeting at an angle which throughout most of its length bears a carina; apical carina absent; areolet moderately large, petiolate; nervulus post-furcal by more than one-half its length. Petiolar fovea small, far in front of spiracle; spiracle of second tergite a little beyond middle, gastrocoeli broad-oval.

Head, thorax, propodeum, first abdominal segment, second tergite except apex, sixth and following tergites, sheath, coxae, trochanters, middle femora, hind femora and hind tibia, black; remainder of front legs pale yellowish-brown, the femora blackish at base and behind, apical tarsal segments brownish; middle tibia and tarsi brownish, former with a yellowish stripe on outer surface; hind tibia with an obscure, brown stripe on basal two-thirds, inwardly, behind; hind tarsi dark brown; calcaria sordid yellowish; stigma and veins dark brown, membrane pale brownish.

Male—The propodeal carinae differ as noted in Viereck's description of *edmontonensis*, otherwise the male agrees rather closely with the above description of the female. The leg colour is as described by Viereck except the front and middle femora which are pale reddish except for the blackish base of latter. Viereck inadvertently refers to the male claspers as "sheaths".

Distribution—The type of *seamansi* is from Waterton, Alta., and that of *edmontonensis* from Edmonton, Alta. There is also a female in the Canadian National Collection from Canim Lake, B.C., and a male in the United States National Museum bearing the data, N. Boulder Cr., Boulder Co., Colo. (Canadian Zone).

38. **Campoplegidea bicoloripes** (Vier.)

Amorphota bicoloripes Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 183, 184, 1926.

Type—No. 1766 in the Canadian National Collection, Ottawa, Ont.

This species conforms very closely with the foregoing description of the female of *seamansi*. The propodeum differs slightly in having the angle between the dorsal and lateral surfaces more rounded and without a carina and, as noted in the key, the apex of the abdomen is reddish. It seems very probable that these differences will not be maintained when a series of specimens is available; until such time, however, both specific names are retained.

Host—The type, which is the only known specimen, was reared from *Archips conflictana* Wlk., at Aweme, Man.

39. **Campoplegidea rotunda** n. sp.

Resembles *vicina* but with occipital and hypostomal carinae uniting distinctly before the base of mandible; propodeum also broader and with only a weak, basal carina.

Female—Length 8.5 mm. Temples rounded, rather strongly receding; malar space two-fifths basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-half basal width of latter; face, including clypeus, very slightly longer than broad; clypeus rather shining; ocellocular space equal to diameter of lateral ocellus. Scutellum broad, weakly convex, disk margined by carina almost to apex; mesopleura with small, evenly spaced punctures, spaces between punctures finely sculptured; speculum shining, weakly rugulose below and almost smooth in region above fovea; apex of propodeum scarcely attaining middle of dorsal surface of hind coxa, median sulcus broad, region on either side of sulcus evenly, rather strongly, rounded to sides; basal carina of propodeum very weak, apical carina absent; sculpture of propodeum rather fine, especially at base, consisting for most part of small, irregular, more or less transverse rugulae; areolet moderately large, petiole short, second recurrent at middle; nervulus post-furcal by approximately one-fourth its length. Petiole with a small fovea on either side before spiracle; second tergite moderately long, spiracle a little before apical third, gastrocoeli elongate.

Head, thorax, propodeum, first abdominal segment, basal two-thirds of second tergite, sheath except apex, coxae, trochanters, middle femora except apices and hind legs except calcaria, black; front femora, tibiae and tarsi yellow, the femora suffused with blackish at base and along posterior surface, apical segments of tarsi blackish; basal half of mandible blackish; palpi brown; veins and stigma dark brown, membrane faintly brownish; abdomen reddish except as noted above.

Holotype—♀, Baddeck, N.S., July 2, 1936, (J. McDunnough); No. 4502 in the Canadian National Collection, Ottawa, Ont.

40. **Campoplegidea occidentalis** (Davis)

Campoplex occidentalis Davis, Trans. Am. Ent. Soc., XXIV, 361, 1897.

Type—Male, Seattle, Wash., No. 4469 in Academy of Natural Sciences, Philadelphia.

Identification of this species is based on two female specimens from Steelhead, B.C., July 4, 6, 1933, (H. B. Leech) which agree with Davis' original description and with notes on the type kindly furnished to me by Mr. W. J. Brown and Dr. O. Peck.

The following description is drawn from the Steelhead specimens. Structurally the species is very similar to *grahami*.

Female—Length 7 mm. Temples moderately receding, rounded behind; malar space scarcely one-third basal width of mandible; occipital and hypostomal carinae uniting very close to base of mandible; ocellocular space slightly less than diameter of lateral ocellus; face, including clypeus, slightly longer than broad. Mesopleura evenly, rather finely punctate, mat; speculum shining; disk of scutellum with carinae on basal two-thirds of lateral margins; propodeal sulcus shallow; dorsal surface of propodeum evenly rounded to sides; basal transverse carina very weak; lateral arms strongly divergent; apical carina absent; areolet slightly oblique, petiolate, second recurrent received distinctly beyond middle; nervulus post-furcal by distinctly less than half its length. Petiole with a faint impression on either side before spiracle; second tergite moderately long, spiracle distinctly beyond middle, gastrocoeli oval.

Head, thorax, propodeum, first abdominal segment, second tergite except narrow apex, abdomen beyond base of sixth tergite, sheaths, coxae, trochanters, hind femora and tegulae, black; front femora and beyond, except apical tarsal segment, reddish; middle femora reddish, infuscated at base and along posterior surface; middle tibia pale reddish; middle tarsi yellowish at base, three apical segments mostly blackish; hind tibia blackish at base and apex, intervening portion dark brown; hind tarsi blackish, extreme base paler; calcaria yellowish; mandibles blackish, except along upper margin and at apex; palpi stramineous; abdomen reddish except as noted above; stigma and veins dark brown, membrane brownish tinged.

41. **Campoplegidea grahami** n. sp.

Structurally very similar to *occidentalis* but readily distinguished by the reddish hind femora and tibiae.

Female—Length 8 mm. Temples moderately receding, rounded behind; malar space one-third basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-third basal width of latter; ocellocular space equal to diameter of lateral ocellus. Mesopleura feebly shining, speculum more shining, the latter in part almost without sculpture; propodeal sulcus distinct; basal transverse carina weak; apical carina absent; sides of propodeum evenly rounded to dorsal surface; areolet rather oblique, petiolate, second recurrent

received slightly beyond middle; nervulus post-furcal by one-half its length. Petiole with a faint impression in front of spiracle; spiracle of second tergite distinctly beyond middle, four times its own diameter from lateral margin, gastrocoeli elongate.

Head, thorax, propodeum, first abdominal segment, basal two-thirds of second tergite, fifth (except base) and following tergites, tegulae, coxae, hind trochanters and hind tarsi, black; remainder of legs, except tips of tarsi, reddish; mandibles black except small section before apex; abdomen reddish except as noted above; stigma and veins dark brown, membrane pale brownish tinged.

Holotype— ♀, Aspen Grove, B.C., July 13, 1933, (K. Graham); No. 4502 in the Canadian National Collection, Ottawa, Ont.

Paratype— ♀, Colo., No. 1342, Coll. C. F. Baker, in United States National Museum.

42. **Campoplegidea fossata** (Vier.)

Campoctonus fossatus Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 182, 1926.

Type—No. 1614 in Canadian National Collection, Ottawa, Ont.

Resembles *americana* but malar space broader, temples less strongly receding, petiolar fovea more distinct, disk of scutellum usually less completely margined by carinae, and stigma paler.

Female—Length 7.5–8.5 mm. Temples rather strongly curved, weakly receding; malar space one-half basal width of mandible; occipital carina extending to base of mandible without joining hypostomal carina, the former somewhat outcurved just before base of mandible so that gena is narrowed; ocellocular space equal to diameter of lateral ocellus. Mesopleura dull, speculum entirely shagreened; disk of scutellum more or less margined on sides at base; propodeal sulcus broad, shallow; basal carina weak; apical carina absent; areolet with a short petiole; nervulus post-furcal by half its length. Petiole with a small but distinct fovea on either side in front of spiracle; second tergite (in lateral aspect) twice as long as high at apex, gastrocoeli short, oval.

Head, thorax, propodeum, coxae, middle and hind trochanters, first abdominal segment, basal two-thirds of second, sixth and following segments, and sheath, black; palpi and legs, except as above noted, reddish, the hind tarsi more or less fuscous, and the hind femora occasionally somewhat blackish; stigma yellowish-brown, veins brown, membrane brownish tinged; tegulae reddish-brown.

Male—Propodeum sometimes a little more coarsely sculptured than in female and with traces of apical carina on either side of median sulcus.

Distribution—In addition to the male type from Aweme, Man., sixteen specimens are at hand from the following localities. Que.: Kazubazua; Ont.: Carp, Constance Bay; Man.: Riding Mountain Park; Alta.: Bilby.

43. **Campoplegidea woodi** Vier.

C. (Viereckiana) woodi Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 173, 177, 1926.
C. (Viereckiana) erythrosoma Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 174, 177, 1926. (New synonymy).

Types—The types of *woodi* and *erythrosoma* are Nos. 1753 and 1755, respectively, in the Canadian National Collection. The abdomen of the type of *woodi* is detached from the body and glued to the locality label.

In addition to the types, a series of both sexes from several localities has been studied. This has clearly indicated that *woodi* and *erythrosoma* are sexes of the same species. The following descriptive notes are based on the above material.

Female—Length 8–10 mm. Temples weakly curved, rather strongly receding; malar space one-fourth basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible a little less than one-half basal width of latter; ocellocular space about two-thirds diameter of lateral ocellus; face narrow, including clypeus, distinctly longer than broad. Mesopleura evenly, finely punctate, mat, speculum dullish and minutely rugulose; mesonotal carina strong opposite base of front wings and produced in region of scutellar groove; scutellum weakly convex, lateral carinae of disk strong at base, extending almost to apex; propodeum rather narrow, median sulcus broad and shallow, especially in anterior portion; propodeum above rather finely, irregularly rugulose; basal transverse carina distinct; apical carina distinct laterally, often extending forward for some distance on either side of median sulcus; areolet small to medium in size, petiolate, intercubiti forming a moderately acute angle; nervulus post-furcal by about one-third its length. Petiole without distinct fovea, usually with a slight groove formed by the convergence of two carina far in front of spiracle; second tergite elongate, viewed laterally, three times as long as high at apex, spiracle at apical two-fifths, gastrocoeli very narrowly elongate.

Head, thorax, propodeum, first tergite except sometimes apex of post-petiole, most of basal two-thirds of second tergite, sheath except apex, and all coxae, black; palpi, mandibles except tips, front legs beyond coxae, most of middle femora and beyond, yellowish; middle and hind trochanters brownish to blackish; hind femora reddish; hind tibia varying from entirely reddish to mostly brownish, sometimes with an obscure yellowish streak on basal two-thirds; hind tarsi reddish to brownish; tegulae yellowish to pale brown; abdominal tergites reddish except as noted above; veins and stigma brown, membrane faintly brownish.

Male—In structure very similar to female, sometimes with propodeum a little more coarsely sculptured and apical carina extending almost to lateral arms of basal carina. Tegulae and front and middle legs including coxae, yellow.

Distribution—The type of *woodi* is a male from Coldstream, Ont.; that of *erythrosoma* is a female from Montreal, Que. Specimens from the following localities have also been studied. Que.: Brome; Ont.: Niagara Glen, Point Pelee; Va.: Falls Church, Rosslyn; Md.: Cabin John, Plummers Isd.; Pa.: Roxborough; Ohio: Columbus, Urbana.

44. **Campoplegidea americana** (Ashm.)

Casinaria americana Ashmead, Bull. Colo. Biol. Assn., No. 1, 22, 1890.
Pseudocasinaria americana (Ashm.) Viereck, Proc. U. S. N. M., XLII, 644, 1912. (Genotype).
C. (Viereckiana) erythromera Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 173, 177, 1926. (New synonymy).

Types—The type of *americana* is in the United States National Museum; that of *erythromera* is No. 1754 in the Canadian National Collection, Ottawa, Ont. The type of *americana* is badly damaged, the head, abdomen, one front wing, one middle and one hind leg being missing.

A specimen, labelled as having been compared with the type of *americana* by Mr. R. A. Cushman, has been carefully compared with the type of *erythromera* and is without doubt the same species.

This species is quite similar to *woodi* and agrees with the description given for that species except in the following respects.

Female—Length 7–8 mm.; malar space approximately one-third basal width of mandible; ocellocular space about equal to diameter of lateral ocellus; median sulcus of propodeum very shallow; basal carina short; apical carina indistinct, rarely extending forward on either side of sulcus; second tergite a little less elongate than in *woodi*.

Tergites beyond the fifth largely or entirely black; hind tibia usually blackish at apex.

Male—As in female, front and middle legs pale reddish, sometimes mostly yellowish beyond the femora.

The type of *americana* is from West Cliff, Colo. The type of *erythromera* does not bear a locality label. Other specimens are at hand as follows. Ont.: Bothwell, Pt. Pelee, Normandale, Vineland Sta.; B.C.: 100 Mile House; Ohio: Columbus, Cleveland, Bedford; Mich.: Detroit; N.Y.: Oswego, Babylon, Long Isl.; Mass.: Nantucket; N.J.: New Brunswick; D.C.: Potomac Flts.; Va.: Rosslyn, Vienna, Great Falls; Pa.: Highspire; Md.: Pr. Geo. Co.; Ala.: Jackson; Tex.: Marshall.

Group IX *(gracilis)*.

The following five species form a small group somewhat intermediate between the *glauca* and *texana* groups. *Gracilis* of the present group approaches in form such species as *woodi* and *americana* of the *glauca* group. *Interstitialis* stands at the other extreme, its structure suggestive of such species as *arizonensis* of the *texana* group. *Townsendi* approaches *interstitialis* in structure, while *expertus* and *rufigaster* appear more closely allied to *gracilis*. All five species agree in having the mesopleura rather coarsely punctate and at most faintly sculptured between the punctures, and the petiole entirely devoid of foveae or impressions.

45. **Campoplegidea gracilis** n sp.

Resembles *woodi* closely but mesopleura more shining, propodeal sulcus narrower and rather strongly impressed at middle, and the scutellum with disk margined by lateral carinae only at extreme base.

Female—Length 9 mm. Temples rounded, moderately receding; malar space one-fourth basal width of mandible; occipital and hypostomal carinae uniting at base of mandible; ocellocular space nearly equal to diameter of lateral ocellus; face, including clypeus, longer than broad. Mesoscutum densely punctate, mat; mesopleura rather coarsely, densely punctate, shining, spaces between punctures only very faintly sculptured, speculum with a polished area; scutellum small, convex, densely punctate, shining, disk without lateral carinae except at extreme base; propodeum rather narrow, basal transverse carina short and rather weak, apical carina absent, median sulcus narrowly impressed at middle; areolet small, narrow, petiolate, recurrent received at or a little beyond middle; nervulus post-furcal by almost one-half its length. Petiole polished, without lateral fovea or impressions; second tergite slender, elongate, viewed laterally, almost four times as long as high at apex, gastrocoeli long and narrow, spiracle distinctly beyond middle.

Colour very similar to *woodi*; front coxae yellow at apex, scape reddish-brown below.

Holotype— ♀, N. Bloomfield, Pa., June 29, (J. N. Knull). In United States National Museum.

Paratypes— ♀, Riding Mountain Park, Man., June 13, 1938, (W. J. Brown); No. 4504 in the Canadian National Collection, Ottawa, Ont.; ♀, Put-in-Bay, Ohio, July 13, 1922, (U.S.N.M. Coll.); ♀, Sea Cliff, Long Island, N.Y., May, (N. Banks) (Mus. Comp. Zool. Coll.).

Two specimens in the National Collection apparently pertain to this species but because of slight differences are omitted from the type series. They consist of a female from Carp, Ont., May 29, 1934, and a male (without locality data) May 24 (from Harrington Coll.). These have the pleura more densely punctate, the nervulus only slightly post-furcal and the recurrent received much beyond the middle of the areolet. In size they are slightly smaller than the type of *gracilis*.

46. **Campoplegidea townsendi** n. sp.

The short, strongly elevated, more or less tubercle-like frontal carina, distinctly receding temples, polished mesopleura, evenly rounded and closely punctate propodeum and the absence of grooves or foveae on the petiole are the principal distinguishing characteristics of this species.

Female—Length 10 mm. Temples rather weakly curved, distinctly receding; malar space two-fifths basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-half basal width of latter; ocellocular space equal to diameter of lateral ocellus; frontal carina elevated to form a laterally-compressed tubercle on middle of front; inter-antennal region with short vertical rugulae. Prepectoral carina ending freely above on mesopleura; mesopleural punctures rather large, intervals between punctures polished, speculum with a polished area; scutellum small, convex, without lateral carinae; propodeum moderately narrowed, median sulcus impressed at middle, sides of propodeum evenly rounded to dorsum; basal transverse carina distinct only in median portion; short lateral sections of apical carina present; surface of

propodeum evenly, densely punctate and latera ly, finely rugulose, vestiture rather dense; areolet rather small; nervulus only slightly post-furcal. Petiole without lateral impression or fovea; second tergite rather long, spiracle at apical two-fifths; gastrocoeli narrowly elongate.

Head, thorax, propodeum, first abdominal segment except apex of post-petiole, base of second tergite at middle, seventh tergite and beyond, coxae, trochanters and hind femora, black; mandibles blackish; palpi dark brown; tegulae yellowish in front, brownish behind; front and middle femora dark brownish-black with entire anterior surface of front femora and apex of middle femora yellow; front and middle tibiae and tarsi yellow, the former with a narrow brownish stripe behind and the latter with apical two segments brownish; hind tibiae and tarsi dark brown, the extreme base of tibia yellow with a sordid yellowish stripe extending along basal two-thirds of posterior surface; veins and stigma dark brown, membrane pale brownish; abdomen with apex of post-petiole, most of second tergite and the four following tergites, reddish; apex of abdomen blackish.

Male—Very similar to the female. Differs in colour only in having the sixth tergite largely blackish.

Holotype—♀, South Fork, Eagle Creek, White Mts., N.M. (elevation about 8,000 ft.) Aug. 1918 (Townsend).

Allotype—♂, same data as holotype.

Paratype—♂, same data (except Aug. 1916) as holotype.

Types in United States National Museum. Paratype, No. 4916 in Canadian National Collection.

47. **Campoplegidea interstitialis** n sp.

Plate I, Fig. 8.

Easily recognized by the shining mesopleura, narrow, impressed, propodeal sulcus, very strongly receding temples and large areolet. This species shows a tendency to approach such forms as *arizonensis* and may possibly have affinities with the *texana* group. In the present group it is allied to *gracilis* and *townsendi* with which it shares the shining mesopleura and narrow sulcus and from both of which it differs in the laterally margined scutellum and more strongly receding temples, and in the other respects noted in the key.

Female—Length 11 mm. Temples rather flat and strongly receding; malar space two-fifths basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible three-fifths basal width of latter; ocellocular space slightly more than one-half diameter of lateral ocellus; face, including clypeus, longer than broad, narrowed slightly below; front slightly concave, median carina indistinct. Mesopleura densely, rather coarsely punctate, spaces between punctures not distinctly sculptured, speculum shining with a small polished area; prepectoral carina rather strong, ending freely above on mesopleura; scutellum rather large, apex sloping and slightly flattened, disk margined by lateral carinae except at apex; areolet large and rather broad, second recurrent received

approximately at middle; nervulus post-furcal by about one-half its length; propodeum evenly rounded to sides, densely rugulose and punctate, median sulcus narrow and rather sharply impressed at middle; median portion of basal carina very short, lateral sections directed more strongly posteriorly than usual thus forming a broadly acute angle; apical carina scarcely distinguishable laterally from the several adjacent rugulae. Petiole polished, cylindrical, without fovea or impression; post-petiole rather slender, elongate; second tergite moderately long, spiracle distinctly beyond middle, gastrocoeli elongate-oval; ovipositor slender, sheath narrow with rounded apex.

Black; mandibles with a yellowish spot before apex; palpi dark brown, blackish at base; tegulae yellow; line on front trochanters, anterior surface and apex of front femora, apex of middle femora, entire front and middle tibiae and tarsi except brownish apex of latter, and extreme base of hind tibia, yellow; remainder of hind tibia dark brown shading to blackish at apex; hind calcaria yellowish-brown, darker at apex; hind tarsi black above, brownish below; veins and stigma dark brownish-black; petiolar segment black, post-petiole dark reddish on apical half; second tergite reddish except for black triangle on basal half, side line of second tergite and sub-integumental line of third, black; sheath blackish; abdomen otherwise reddish.

Holotype—♀, Ste. Agathe des Monts, Que., Aug. 6, 1937, (G. S. Walley); No. 4505 in the Canadian National Collection, Ottawa, Ont.

Paratype—♀, same data as holotype.

48. **Campoplegidea experta** (Cress.)

Campoplex expertus Cresson, Trans. Am. Ent. Soc., IV, 171, 1872.

Type—A male from Texas, No. 1557 in Academy of Natural Sciences, Philadelphia.

Identification of this species is based on a paratype and a series of specimens in the United States National Museum, also on notes on the type supplied to me by Mr. W. J. Brown. The paratype has the abdomen detached and glued to the locality label and I am convinced that this abdomen does not correctly pertain to the specimen on the pin. It does not agree with the abdomen of the type (which according to Mr. Brown is also detached and glued on). The abdomen of the type has the petiole without a fovea on either side, whereas the one associated with the paratype is foveate with the third tergite inflexed as in *associata*. Additional specimens from Texas agree exceptionally well with the paratype before me except in abdominal structure. In the latter respect they agree with Brown's notes on the type.

This species and *rufigaster* are readily distinguished from all the preceding species discussed in this paper except *glauca*, in having the petiole and post-petiole conspicuously reddish. In *glauca* the petiolar fovea is always distinct, whereas in *experta* and *rufigaster* it is entirely lacking.

Next to *rufigaster*, in this group, *experta* most closely resembles *gracilis* from which it differs, however, in the reddish petiole, distinctly larger and broader areolet, and in having the hind tibiae narrowly yellowish at the extreme base.

The female is here described for the first time.

Female—Length 10–10.5 mm. Temples evenly rounded, rather strongly receding; malar space one-fourth to almost one-third basal width of mandible; occipital and hypostomal carinae uniting slightly before base of mandible; ocellocular space slightly less than diameter of lateral ocellus; median carina of front indistinct. Mesopleura with large, rather dense punctures, intervals between punctures and speculum polished; prepectoral carina laterally distinct, extending freely above on mesopleuron; mesoscutum densely punctate, mat; scutellum rather shining with numerous, distinct punctures, basal one-half of lateral margins of disk with weak carinae; propodeum rather slender, dullish, densely, evenly punctate, becoming more rugulose in the rather narrow, but usually strongly impressed, median sulcus; basal carina very short; apical carina absent; dorsal surface of propodeum evenly rounded to sides; areolet rather large and moderately broad, sessile or with short petiole; second recurrent received close to middle of areolet; outer posterior angle of second discoidal cell rectangular or slightly obtuse; nervulus post-furcal by about one-half its length; claws with only a few short teeth near base. Petiole smooth and cylindrical, without lateral fovea or impression; second tergite moderately long, spiracle beyond middle, gastrocoeli elongate; sheath slender, rounded at apex.

Head, thorax and propodeum black; coxae black, the anterior pair yellow at apex; abdomen reddish, second tergite with a triangular blackish area on basal half; sheath blackish with apex brownish; mandibles yellow, base and apex narrowly blackish; palpi and tegulae yellow; front legs beyond coxae, middle legs at apex of femora and beyond, and extreme base of hind tibia, yellow; apices of front and middle tarsi pale brownish; middle and hind trochanters and femora reddish; hind tibia beyond base reddish, shading to brownish near apex; hind tarsi brownish, the basal segment pale at base; hind calcaria yellowish; veins and stigma brown.

Male—Agreeing closely with the female in structure and colour.

Distribution—Eleven specimens are known to the writer from the following localities: Tex.: Bosque Co. (Belfrage) (Type and Paratype), Dallas, Plano; Va.: Vienna; Ind.: Mineral Springs; Kan.: Riley Co.; Ia.: Henry Co.; Okla.: Stillwater.

49. **Campoplegidea rufigaster** n. sp.

Very similar to *experta* and agreeing with the description of that species except in the following respects.

Female—Length 12 mm. Malar space almost one-half basal width of mandible; ocellocular space fully as great as diameter of lateral ocellus. Mesopleura densely punctate, faintly sculptured between punctures; areolet small and rather narrow.

Mandibles blackish on basal half; front coxae entirely black; front trochanters and base of femora reddish, hind tibiae more uniformly reddish, with the base only obscurely yellowish.

Holotype— ♀, Hampton, N.H., June 25, 1917, (S. Albert Shaw).

Paratypes—♀, Glenside, Pa., July 10, 1934, (G. G. Sleesman); ♀, Plummer's Isl., Md. (R. A. Cushman).

Holotype and paratype in United States National Museum. Paratype, No. 4917, in Canadian National Collection.

Notes—The female paratype from Plummer's Isl. measures 11 mm., but otherwise agrees with the type.

Group X *(texana).*

The eleven species which follow constitute one of the most distinct groups in the genus. They differ from all other species in having the scutellum strongly flattened or impressed and the petiolar segment slightly upcurved in lateral aspect. Additional characters which will aid in their recognition are the slender petiole and post-petiole, the absence of a lateral fovea or impression on the former, the slender second tergite with its gastrocoeli usually at or slightly before the middle, the uninflexed lateral margins of the third tergite, and the narrow and rather sharply impressed longitudinal sulcus of the propodeum. This last character does not apply to *texana* and *scalaris* which may be regarded as a distinctive sub-group characterized by the form of the propodeum, its carinae and sulcus, as described under *texana*. The remainder of the species may be divided into two sub-groups dependent on the presence or absence of dorso-lateral carinae on the petiole.

50. **Campoplegidea texana** (Ashm.)

Casinaria texana Ashmead, Proc. U. S. N. M., XII, 427, 1889.
Fiebrigia texana (Ashm.) Viereck, Proc. U. S. N. M., XLII, 638, 1912. (Genotype).

In this species and the one following the posterior portion of the propodeum is extraordinarily long and "neck-like", extending posteriorly almost as far as the apex of the hind coxae. Also the propodeal sulcus is broad and very shallow, and posteriorly strongly, transversely costate, the propodeal spiracles are short-oval, and the lateral longitudinal carinae are distinct, but incomplete posteriorly. These characters will readily distinguish *texana* and *scalaris* from the remaining species having a flattened or impressed scutellum and a slender, more or less up-curved petiolar segment.

Type—A female from Texas (Belfrage) in the United States National Museum.

Discussion of this species is based on a female, presumed to be from Guatemala, (intercepted in shipment of bananas at Charleston) which was compared with the type by Mr. Cushman. With it I associate a male from Lawrence, Kansas. Mr. Cushman informs me that the above female, which is described below, differs from the type in the following respects: Propodeal carinae more distinct; middle coxae largely blackish; antennae only obscurely reddish at apex; second tergite largely black.

Female—Length 8 mm. Temples moderately rounded, strongly receding; malar space scarcely one-third basal width of mandible; occipital and hypostomal carinae not uniting before base of mandible; ocellocular space three-fifths diameter of lateral ocellus; face, including clypeus, almost as broad as long. Mesopleura shining and densely punctate;

speculum finely rugulose; prepectoral carina ending freely above on mesopleuron; mesoscutum and scutellum dullish, shallowly, densely punctate; scutellum broad at apex, low, with a median impression on apical portion. Propodeum slender, its apex almost attaining apex of coxae; median propodeal sulcus broad, shallow, strongly transversely ribbed; basal carina well defined; apical carina distinct, transverse laterally and medianly extending forward on either side sulcus to almost attain basal carina; lateral carina distinct from base of propodeum to where it joins apical carina; spiracle short-oval; areolet small, narrow, petiolate; second recurrent distinctly beyond middle of areolet, forming an acute angle with subdiscoideus; nervulus slightly post-furcal; legs slender, especially posterior pair. Petiole slender, cylindrical, gradually enlarging to postpetiole, entire segment slightly up-curved; second tergite narrow, elongate, spiracle at apical one-third, gastrocoeli at middle; sheath of moderate breadth and length.

Head, thorax and propodeum black; scape yellowish below, yellowish-brown above; flagellum black at base, becoming dark brown toward apex; mandibles except teeth, also palpi, tegulae, wing bases, front and middle legs except base of middle coxae, and all calcaria, yellow; basal two-thirds of middle and entire hind coxae, black; hind trochanters, femora and tibia reddish; hind tarsi dark brownish; abdomen reddish, petiolar segment entirely so; second tergite blackish except narrowly along sides and at apex; remaining tergites reddish; sheath blackish; wings faintly dusky, stigma and veins brown.

Ashmead's description makes no mention of blackish on the second tergite but in the type this segment is distinctly darker than the following. The type appears to be a rather immature specimen which might account for the reduction in blackish in this region.

The male which I associate with this species is represented by a single, somewhat discoloured specimen from Lawrence, Kansas, April 30, 1896 (Hugo Kahl). In this specimen the notauli are slightly indicated in front and the areolet is unusually small with a long petiole. The f ont and middle legs are entirely pale yellow except the tips of the tarsi and the extreme bases of the middle coxae which are pale brownish. In the male of *scalaris* the front and m dd e femora are reddish and the middle coxae black.

51. **Campoplegidea scalaris** (Prov.)

Campoplex scalarius Provancher (*scalaris* in Index). Add. et corr. au Vol. II, Faun. Ent. Can. 84, 1889 (♀ nec ♂).
Pseudocasinaria scalarius Provancher, Viereck, Trans. Roy. Soc. Can., Sec. V, 182, 1926.

Very similar in structure and colour to *texana* (Ashm.) and perhaps not distinct from that species, the material at hand differing however as noted in the key.

Type—A female, from Cap Rouge, Que., No. 1219 in Provancher Collection, Quebec Public Museum.

The male referred to by Provancher is in the National Collection. It pertains to another genus.

The above female differs from Provancher's original description in having the first and second abdominal tergites reddish instead of black. In other respects it conforms very closely so that it seems probable that the description is in error in this respect.

The following descriptive notes on the female are from the type.

Female—Temples rounded, rather strongly receding; malar space a little less than one-half basal width of mandible; ocellocular space distinctly less than diameter of lateral ocellus; occipital and hypostomal carinae uniting at base of mandible. Mesoscutum dul ish, densely punctate; scutellum flattened, apical portion impressed; propodeum "neck-like" in apical portion, extending almost to apex of hind coxae; spiracles oval; basal carina distinct, its apices joining lateral longitudinal carinae; areolet small, narrow, petiole long, second recurrent received a little beyond middle; nervulus slightly post-furcal. Petiole of abdomen polished, cylindrical, without dorso-lateral carinae.

Head and thorax black; mandibles, tegulae and palpi yellow; coxae black, except apices of anterior pair; trochanters of front and middle legs, apices of front femora and upper surface of front tibiae, yellow; remainder of front legs, and femora, tibiae and tarsi of middle legs, reddish-yellow; hind femora pale reddish-brown; hind tibia pale yellowish-brown; abdominal tergites reddish with crests of tergites dusky, especially on the last three tergites.

Male—Agreeing with female except as follows: nervulus more strongly post-furcal; hind tibia brownish-black; first two abdominal tergites mostly brownish; crests of third and fourth tergites not dusky; dorsal half of last three tergites black.

Distribution—Known only from the type from Cap Rouge, Que., and the above described male from Edmonton, Alta., July 3, 1932, (O. Peck).

52. **Campoplegidea simulans** n. sp.

This species resembles *experta* and *rufigaster* but because of the flattened, impressed scutellum and slender, slightly upcurved petiolar segment it appears more closely allied to the members of the present group. It differs from the majority of these however in its larger size and somewhat stouter second tergite, which has the gastrocoeli in the region of the basal third, whereas in other species they lie close to the middle.

Female—Length 13.5 mm. Temples weakly curved, strongly receding; malar space two-fifths basal width of mandible; occipital and hypostomal carinae uniting very slightly before base of mandible; ocellocular space slightly less than diameter of lateral ocellus; front slightly sunken, median carina distinct, punctures very dense. Mesopleura polished, coarsely, densely punctate; prepectoral carina strong, curving to anterior margin of mesopleuron well above the middle; mesoscutum somewhat shining, scutellum more so, both coarsely, densely punctate, latter with apical half strongly flattened and slightly impressed; apex of propodeum extending to apical one-third of hind coxae; median sulcus of propodeum rather narrow and deeply impressed, strongly transversely rugose; basal carina

of propodeum distinct, apical carina absent; propodeum rather strongly rugose and punctate, the rounded shoulders beyond apices of basal carina with several strong, short, transverse rugae; propodeal spiracles narrow, elongate; areolet rather large and moderately broad, recurrent received slightly before middle; nervulus post-furcal by fully one-half its length. Petiolar segment slender, petiole without dorso-lateral carinae.

Head, thorax, propodeum and coxae black; mandibles, palpi, tegulae, front legs beyond coxae, middle tibia and tarsi, yellowish; front femora pale reddish behind; middle and hind trochanters and femora, also hind tibia except narrow yellowish base, reddish; hind tarsi brownish-black; abdomen reddish, petiole infuscated above, second tergite with a blackish triangular area extending a little beyond middle; sheath blackish; stigma and veins dark brown.

Holotype—♀, Rutherford, N.J., Sept. 6, 1923, (F. M. Schott). In United States National Museum.

53. **Campoplegidea arizonensis** n. sp.

Plate I, Fig. 9.

Differs from all species in the present group, except *simulans*, in having the second recurrent received at or before the middle of areolet. Easily distinguished from *simulans* by the uniformly blackish middle and hind femora, and the more finely, evenly sculptured and less strongly sulcate propodeum.

Female—Length 10.5 mm. Head thin antero-posteriorly; temples nearly flat, very strongly receding; genae rather narrow; malar space scarcely one-fourth basal width of mandible; occipital and hypostomal carinae uniting very close to base of mandible; ocellocular space slightly less than diameter of lateral ocellus; front shallowly punctate, with fine, median, vertical carina. Mesopleura polished, rather coarsely, densely punctate; prepectoral carina distinct, ending freely above near anterior margin of mesopleuron; mesoscutum densely punctate, notauli indicated by shallow impressions anteriorly; scutellum feebly convex in front, flattened behind, with dense punctures which are more or less confluent on posterior portion; propodeal spiracles narrow, elongate; basal carina of propodeum distinct only at middle; median sulcus narrow, moderately impressed; propodeum evenly rounded to sides, shallowly, densely punctate, intervals between punctures often forming small irregular rugulae; areolet rather large, second recurrent received slightly before middle; nervulus post-furcal by about one-half its length. Petiole without dorso-lateral carinae; spiracle of second tergite at apical one-third, gastrocoeli a little before middle; sheath short, slender, somewhat rounded at apex.

Head and thorax black; antennae dark brownish-black; mandibles black at base and along lower half; palpi yellowish, stained with brown; tegulae and wing bases yellow; all coxae black; front legs beyond coxae yellow, with posterior surface of trochanters and basal half of posterior surface of femora, brown; middle and hind trochanters, femora except tips of middle pair, hind tibia and tarsi except narrow yellow annulus at base of hind tibia and extreme base of hind tarsus, dark brownish-black; middle

tibia entirely yellow; middle tarsus yellow, somewhat pale brownish on the two apical segments; calcaria of hind legs yellow; wings faintly brownish; stigma and veins brown. First abdominal segment reddish, with a blackish suffusion on base of petiole extending dorsally along petiole and base of post-petiole; second tergite reddish, with blackish triangular area at base extending apically to include thyridia and terminating in median line at apical four-fifths of tergite; remainder of abdomen reddish; sheath blackish.

Male—Very similar to female in structure and colour.

Holotype— ♀, Sabino Canyon, Ariz., Nov. 24, 1917, (W. D. Edmonston). (Resting on blossom.)

Allotype—♂, same data as holotype.

Paratypes—2 ♂♂, 2 ♀♀, same data as holotype; 1 ♂, same locality and collector, Nov. 1917, (Flying); ♀, Tucson, Ariz., Alt. 2400, Mar. 30, 1926, (A. A. Nichol).

Types and paratypes in United States National Museum. Paratypes, No. 4918, in Canadian National Collection.

Remarks—The following slight variations have been noted in the above series. Two specimens have the face a little longer than broad; two have the mandibles entirely black and in one specimen they are yellow except basally; the amount of blackish suffusion on the first abdominal segment varies, in one example it is less than the type while in three others it is more extensive especially on the post-petiole; one male has the front trochanters and femora entirely yellow and has a prominent yellow spot on the front coxa; in this specimen the crests of the third and following tergites are somewhat blackish, the apical tergites especially so; the areolet is sessile in one specimen and in this and three others the recurrent is received at the middle of the areolet; in three other specimens, including the allotype, it is received distinctly before the middle.

54. **Campoplegidea flavescens** n. sp.

Resembles *arizonensis* but smaller, with recurrent vein very near apex of areolet; scape yellow below, and front and middle trochanters and femora entirely yellow; in *arizonensis* the corresponding parts are largely black. More closely allied to *turmalis* but differing from that species in the distinctly narrower malar space and in the colour of legs as noted in the key.

Agreeing structurally with the description of the female of *arizonensis* except in the following respects.

Female—Length 9.5 mm. Ocellocular space one-half diameter of lateral ocellus. Mesopleura shining, faintly sculptured between punctures; notauli not indicated; scutellum impressed and flattened except at extreme base; areolet small, narrow, second recurrent almost interstitial with second intercubitus; nervulus post-furcal by scarcely one-fourth its length. Sheath short, moderately broad, apex truncate.

Head, thorax, propodeum and coxae black; scape yellow below; flagellum dark brownish-black becoming paler brownish toward apex; mandibles, palpi, tegulae, front and middle legs beyond coxae (middle tarsi missing), narrow basal annulus on hind tibia and hind basi-tarsus except at apex, yellow; remainder of hind tarsi pale yellowish-brown; hind femora and tibia except base, reddish-brown; abdomen reddish with the crest of second tergite blackish on basal two-thirds; sheath brown; veins and stigma brown.

Holotype— ♀, Arizona, (No. 2340), (Coll. C. F. Baker). In United States National Museum.

55. **Campoplegidea turmalis** n. sp.

Differs from *arizonensis* and resembles *flavescens* in form of areolet; differs from both species in having the malar space almost one-half as broad as basal width of mandible. In other respects the structure appears identical with *flavescens* except that the mesopleura lack sculpture between the punctures and the sheath is rounded at apex.

In colour very similar to *flavescens* but with the middle trochanters, femora and hind tarsi dark brownish-black except narrowly at base of latter. The basal four segments of middle tibia yellowish, apical segment pale brown.

Holotype— ♀, Devils River, Tex., May 3, (F. C. Bishopp). In United States National Museum. (Abdomen of holotype detached).

56. **Campoplegidea bellula** D. T.

Plate II, Fig. 14; Plate III, Fig. 4.

Campoplex bellus Cresson, Trans. Am. Ent. Soc. IV, 172, 1872 (nec. *bellus* Cress. 1865).
Campoplex bellulus Dalla Torre, Cat. Hym. III, 138, 1901 (n.n. for *bellus* Cress. 1872).
Campoplex photomorphus Viereck, Kan. Acad. Sci., Biol. Papers, 309, 1905. (New Synonymy).
Idiosomidea photomorpha Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 272, 1925. (Genotype).
Idiosomidea secunda Viereck, Trans. Roy. Soc. Can., XIX, Sec. V, 272, 1925. New Synonymy).
C. (Viereckiana) photomorpha Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 174, 1926 (in key).

Types—The type of *bellus* Cress. 1872, is a male from Texas, No. 1555 in the Academy of Natural Sciences, Philadelphia. The type of *photomorphus* is a female in the University of Kansas Entomological Museum, Lawrence, Kan. The type of *secunda* is a male, No. 1411, in the Canadian National Collection.

Discussion of this species is based on notes on the type of *bellula* furnished by Mr. W. J. Brown, a homotype (Cushman 1934) of *photomorphus*, the holotype of *secunda* and a series of seventeen specimens, also the specimen designated by Cresson as *bellus* var. *a*.

This species is close to *nitida* and agrees with it in having the head moderately thick antero-posteriorly and the temples weakly receding, by which characters both may be distinguished from the four preceding

species. In addition *bellula* and *nitida* differ from *arizonensis* and *simulans* and agree with *flavescens* and *turmalis* in the small, narrow areolet which receives the second recurrent distinctly beyond the middle. *Bellula* differs from *nitida* in having the propodeum with a well defined basal carina.

Female—Length 8–10.5 mm. Temples broadly rounded and only weakly receding; malar space one-fourth to one-third basal width of mandible; occipital and hypostomal carinae uniting a little before base of mandible; ocellocular space slightly less than diameter of lateral ocellus; front with a fine, median, vertical carina. Mesopleura polished, rather densely punctate; mesoscutum and scutellum densely punctate, latter beyond the base flattened and more or less impressed; propodeal spiracles elongate; basal carina distinct, its lateral portions sometimes extending over the rounded shoulders of propodeum; median sulcus narrow, sharply impressed. Areolet small, narrow, second recurrent received distinctly beyond middle; nervulus post-furcal by about one-third its length. Petiole without dorso-lateral carinae; second tergite elongate, spiracle at apical third, gastrocoeli at middle; sheath short, subtruncate at apex.

Head, thorax, propodeum, more or less of first two, and apical two or three tergites, blackish; antennae blackish, flagellum often brownish apically; mandibles, palpi and tegulae yellowish; coxae black; middle and hind trochanters, more or less of posterior surface of front femora, middle and hind femora except apex of former, blackish; more rarely these parts rufo-piceous with hind femora occasionally largely reddish; remainder of front and middle legs yellowish; hind tibia brownish to black, narrowly paler at base; petiolar segment varying from dull reddish to blackish, second tergite varying from largely reddish with a blackish crest on basal two-thirds to almost entirely blackish; abdomen with apical tergites varying from uniformly reddish to a condition in which the apex of the fifth and the following tergites are entirely black; veins and stigma brown.

Male—Resembles the female closely; sometimes with front femora entirely yellow.

Distribution—S. Dak.: Ft. Pierre; Ia.: Iowa Co.; Kan.: Riley Co. (Homotype of *photomorpha*); Colo.: (No locality); Tex.: Rhone; N.S.: Baddeck; N.B.: Waweig; Que.: Hemmingford, Kazubazua; Ont.: Kirkland Lake, Mer Bleue, Ottawa; Alta.: (No locality data, type of *secunda*).

Remarks—This species has been a source of some confusion to previous workers which may be attributed partly at least to the variation which exists in the colour of the abdomen. In the type of *bellula* the first and second segments of the abdomen are black with a slight reddish cast and beyond the segments are reddish. In the specimen designated by Cresson as var. *a*, also in the types of *photomorpha* and *secunda*, the apical two or three tergites are conspicuously blackish. Other specimens have a varying amount of blackish on the apical tergites and the two basal segments vary from largely blackish, with the apex of the second usually reddish, to a dull reddish-brown with only the crest of the second tergite distinctly blackish.

57. **Campoplegidea nitida** n. sp.

The reader is referred to the discussion under the preceding species for remarks concerning the affinities of this species with *bellula* and other members of this group. The present species is known only from the Sierra Nevada Mountains region of northeastern California, whereas *bellula* occurs east of the Rocky mountains from Alberta to Texas and northeast in Canada to Quebec and Nova Scotia.

Differs from *bellula* as follows.

Female—Length 9.5 mm. Temples a little more rounded and slightly less receding than *bellula;* ocellocular space equal to diameter of lateral ocellus; propodeum slightly broader than in *bellula;* basal carina of propodeum indicated only by a very short transverse portion at base of longitudinal sulcus; second recurrent almost interstitial with second intercubitus; nervulus slightly post-furcal.

Mandibles blackish at base, tegulae brown; petiole blackish, post-petiole rufo-piceous; second tergite blackish above, posterior lateral portions reddish; fifth tergite except at base, and following segments, blackish.

Male—Very similar to female; tegulae yellowish-brown.

Holotype—♀, Meadow Valley, Plumas Co., Calif., (elevation 4000–5000 ft.), June 12, 1924, (E. C. Van Dyke).

Allotype—♂, Truckee, Calif., June 12, 1927, (E. P. Van Duzee).

Paratype—♂, Lake Tahoe, Calif.

Types in United States National Museum. Paratype, No. 4919, in Canadian National Collection.

58. **Campoplegidea lobata** n. sp.

Plate III, Fig. 5.

This species and the two following agree in having the petiole with a more or less distinct dorso-lateral carina on either side. In specimens which lack a well defined carina the lateral and dorsal surfaces of the petiole meet at a distinct angle. This character will serve to distinguish *lobata*, *australis* and *deceptor* from the other species contained in the present group. The presence of a prominent lobe, formed by the apex of the mesoscutal carina opposite the base of scutellum, will readily distinguish *lobata* from all other species of the *bellula* group.

Female—Length 10 mm. Temples slightly rounded, fairly strongly receding; malar space a little more than one-fourth basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible approximately one-third basal width of mandible; ocellocular space one-half diameter of lateral ocellus; face, including clypeus, slightly longer than broad; front dullish, with fine, median, vertical carina. Mesopleura rather densely punctate, shining, intervals between punctures very feebly sculptured; mesoscutum and scutellum very densely punctate, the latter broadly flattened and medianly impressed; mesoscutal carina terminating in a conspicuous, erect lobe, on either side, opposite basal

angles of scutellum; propodeal sulcus very narrow; basal carina well defined, its lateral portions subtending to form an angle of slightly less than ninety degrees; surface of propodeum evenly, shallowly punctate and rugulose; propodeal spiracles elongate; apex of propodeum extending slightly beyond middle of dorsal surface of hind coxae. Areolet small, narrow, second recurrent received near apex; nervulus post-furcal by more than one-half its length. Petiole with weak, dorso-lateral carinae; second tergite slender, gastrocoeli at middle; apex of sheath subtruncate.

Head and thorax black; antennae black with apical 12–15 segments brownish; mandibles except tips, and palpi, yellow; tegulae pale brown; coxae, middle and hind trochanters, posterior surface of front femora on basal half and middle femora except apically, blackish; remainder of front legs yellowish; middle tibiae and basi-tarsi yellowish, apical segments of former yellowish-brown; hind femora reddish-brown; hind tibiae and tarsi brownish to blackish, the former narrowly yellowish at base; abdomen reddish, petiole blackish above at base, second tergite blackish basally and along median line almost to apex, sheath of ovipositor blackish; wings slightly clouded, stigma and veins brown.

Male—Length 9 mm. Structure very similar to female; nervulus post-furcal by one-third its length. Scape below with a sordid yellowish stripe; tegulae yellow. Legs as in female except front trochanters and front femora, which are entirely yellow except a small pale brownish patch at base of femora posteriorly; middle femora with yellowish extending to base on anterior surface.

Holotype—♀, Brome, Que., July 21, 1936, (G. S. Walley); No. 4506 in the Canadian National Collection, Ottawa, Ont.

Allotype—♂, Sudbury, Ont. (Forest Insect Survey) emerged in laboratory, May 3, 1937.

Paratypes—♀, Mer Bleue (Ottawa) Ont., Aug. 3, 1936, (O. Peck); ♀, Bell's Corners (Carleton Co.) Ont., July 11, 1936, (G. S. Walley) (flying about spruce); ♀, Aweme, Man., Aug. 3, 1927, (R. M. White); ♀, Falls Church, Va., July 21, (N. Banks) Coll. M.C.Z.; ♀, no data, Coll. United States National Museum; ♂, Sudbury, Ont., (Forest Insect Survey) emerged in laboratory, April 28, 1937; ♂, Espanola, Ont., (Forest Insect Survey) emerged in laboratory, June 6, 1937.

Host—The allotype and the two paratypes from Sudbury and Espanola, Ont., were reared from *Semiothisa granitata* Gn.

In addition to the type series one male, apparently pertaining to this species, is at hand from Shingle Creek, Keremeos, B.C., July 9, 1936, (A. N. Gartrell). This specimen is a little larger than the other males before me, and it has the mesopleura highly polished, the hind femora entirely black and the scape scarcely paler below.

59. **Campoplegidea deceptor** n. sp.

Very similar to *bellula* and *lobata* but differs from the former in having dorso-lateral carinae on the petiole and the abdomen uniformly reddish at apex. Resembles *lobata* closely, and agreeing with the description of that species except as follows.

Female—Length 9 mm. Ocellocular space a little more than one-half diameter of lateral ocellus; mesoscutal carina without a prominent lobe at apex; surface of propodeum rather coarsely rugulose especially in lateral region; apex of propodeum extending fully to apical three-fourths of dorsal surface of hind coxae; second recurrent very close to second intercubitus; nervulus post-furcal by less than one-half its length.

Flagellum scarcely paler at apex; tegulae yellow; middle tarsi yellow, apical segment tinged with brownish; hind femora dark brownish-black.

Male—Length 10 mm. Scape not distinctly paler below; middle femora blackish behind and at base in front.

Holotype—♀, Inglenook (Dauphin Co.) Pa., June 20, 1909, (P. R. Myers).

Allotype—♂, Washington, D.C., June, 1898, (F. C. Pratt).

Paratypes—♀, same data as holotype; ♀, Falls Church, Va., June 17, 1919, (Wm. Middleton); ♀, Long Beach, L. Id., N.Y., Aug. 2, 1925, (F. M. Schott) (in washup); ♀, Indiana, No. 2089, (C. F. Baker); ♀, Earl Grey, Sask., Aug. 2, 1925, (J. D. Ritchie); ♂, Orillia, Ont, June 10, 1925, (C. H. Curran).

Holotype, allotype and paratypes in United States National Museum; first and last two paratypes, No. 4507, in Canadian National Collection.

60. **Campoplegidea australis** n. sp.

Female—Length 11 mm. Structure as in *deceptor*. Differs in colour from that species as follows: scape yellowish-stramineous below, brownish above; apex of flagellum reddish-brown; front legs entirely yellow beyond coxae; middle femora pale reddish at base and behind, otherwise yellow; middle tibiae and tarsi yellow; middle and hind trochanters reddish-brown; hind femora and tibia reddish except narrow yellowish base of latter, hind tarsi pale reddish-brown.

Male—Length 10 mm. Scape bright yellow below; apices of front and middle coxae and beyond, yellow; tips of tarsi sordid yellowish; hind legs and remainder of body as in female.

Holotype—♀, Blacksburg (Cherokee Co.) S.C., June 5, 1917. In United States National Museum.

Allotype—♂, Norfolk Co., Ont., July 11, 1929, (J. A. Hall); No. 4508 in the Canadian National Collection.

Group XI *(tumida)*.

The two species contained in this group, also *ocellata* the sole representative of the following group, might be combined in one group since all three agree in having the abdomen less strongly compressed than is customary for the genus. They also agree more or less in having the propodeum broad, and the legs, especially the femora, rather short and stout, and the post-petiole more or less depressed. However, because of the form of head, especially the non-receding temples, and certain other characters, *tumida* and *pulchella* are placed in one group and *ocellata* is regarded as representing another group.

61. **Campoplegidea tumida** n. sp.

Plate I, Fig. 10; Plate II, Fig. 3

This is a very unusual species, easily recognized by the broad divergent temples and prominent genal swelling, in which respects it differs from all other members of the genus here dealt with. It agrees with *pulchella* in having the face broad, densely punctate and shining, mesoscutum polished and densely punctate, mesopleura shining and with a large smooth speculum, propodeal sulcus broad and deep, dorsal surface of propodeum evenly rounded to sides with no trace of an apical transverse carina.

Female—Length 12.5 mm. Head thick antero-posteriorly; temples broad and diverging slightly so that diameter of head is distinctly greater through temples than through eyes; head, viewed from in front, very broad, the temples visible beyond eyes, narrowed below to the concave genae; genae, viewed from a postero-lateral aspect, with a prominent swelling situated adjacent to occiput and opposite lower extremity of eye; malar space nearly two-fifths basal width of mandible; occipital carina weakly elevated below and curved to join the more strongly elevated hypostomal carina close to base of mandible; ocellocular space equal to diameter of lateral ocellus; face, including clypeus, slightly broader than long, evenly, densely punctate, with short vestiture which is more or less parted along a line below each antenna; front densely punctate, with a median, vertical carina. Mesoscutum polished, evenly, densely punctate; scutellum polished and punctate at base, punctures denser and confused on apex, latter broad, median third of scutellum somewhat transversely impressed (the impression slightly irregular and perhaps somewhat abnormal); mesopleura and metapleura polished, evenly, densely punctate; speculum with a large, polished, impunctate area; prepectoral carina laterally distinct; propodeum short, broad, sides evenly and broadly rounded to dorsal surface, median longitudinal sulcus broad and well defined, basal transverse carina short and weak, apical transverse carina absent; propodeum with numerous, indistinct, shallow punctures, except at base and along polished median sulcus; areolet of moderate size, slightly oblique, second recurrent received beyond middle; nervulus slightly post-furcal; legs rather stout, hind femora four times as long as broad. Petiole without lateral groove or fovea; second tergite with spiracle a little beyond middle; subintegumental line of third tergite distinct; sheath broad, bluntly rounded at apex.

Head, thorax, propodeum, first abdominal segment, basal half of second tergite, apical half of sixth and entire following tergites and sheath, black; palpi dark brown, mandibles black, with a yellow subapical band which extends toward the base along upper margin; coxae, trochanters, front femora anteriorly at base and posteriorly except at apex, middle femora except anteriorly toward apex, hind femora and tibia, black; remainder of front femora, also front and middle tibia except a brownish line posteriorly, yellow; front and middle tarsi mostly brownish, paler toward base; calcaria of hind legs pale brown; posterior tarsi dark brown, paler below; tegulae yellow; stigma and veins blackish, membrane distinctly brownish; abdomen reddish except as noted above.

Holotype—♀, Corvallis, Ore., May 30, 1931. In United States National Museum.

62. **Campoplegidea pulchella** n. sp.

Resembling the preceding species in structure, but much smaller, with temples not diverging and genae without a tumidity. Resembles *ocellata* but differing from that species as noted thereunder.

Female—Length 8.5 mm. Temples not receding for some distance behind eyes, then strongly rounded to occiput; malar space one-third basal width of mandible; occipital carina attaining base of mandible and not uniting with hypostomal carina; ocellocular space slightly greater than diameter of lateral ocellus. Mesoscutum densely punctate, polished between punctures; scutellum low, polished, sparsely punctate except near apex; lateral margins of scutellum without carinae except at base; mesopleura polished, in most parts with punctures separated by twice their diameters, speculum with a large, polished, impunctate area; areolet moderately large, sessile, slightly oblique; nervulus post-furcal by about one-fourth its length; posterior femora rather stout; propodeum broad toward base, sides evenly rounded to dorsum, median sulcus broad and rather deep, more shining at middle than elsewhere on propodeum; basal carina short; propodeum rather dull, finely punctate basally, becoming more coarsely sculptured beyond base, with irregular rugulae apically. Petiole polished, cylindrical, without impressions or foveae; spiracle of second tergite a little beyond middle; gastrocoeli large, elongate-oval; tergites only moderately compressed.

Head, thorax, propodeum, first abdominal segment, second tergite except apex, coxae, middle and hind trochanters and hind femora, black; front femora and beyond bright yellow, the femora with a brownish stripe behind; middle femora yellow in front, dark brown inwardly and behind; middle tibia entirely yellow; middle tarsi pale brown; hind tibia and tarsi dark brown, the tibia with base narrowly yellow; mandibles blackish in lower basal region; palpi, tegulae, wing bases and costal margin of wing almost to stigma, yellow; veins and stigma brown, membrane with a faint brownish tinge; abdomen reddish beyond second tergite, sheaths brownish-black.

Male—Claspers blackish; front coxae with apical yellow spot; middle trochanters yellow in front; middle femora more extensively yellow than in female; middle tarsi yellow; hind tibia with basal two-thirds yellow, apical third blackish, with a narrow pale brownish stripe extending along lower surface to base; base of hind basi-tarsus yellowish.

Holotype—♀, Argus Mountains, Calif., May 1891.

Allotype—♂, Littlefield, Ariz., Mar. 27, 1931, (E. W. Davis). "*Chrysothamnus speciosus*" No. B-9, 1931.

Paratypes—♀, Los Angeles Co., Calif. (Coquillett); ♂, Bucksk. Valley, Iron Co., Utah (Brooklyn Museum Coll. 1929).

Types and paratype in United States National Museum. Paratype, No. 4920, in Canadian National Collection.

Remarks—The female paratype differs from the holotype in having the front coxae yellow at apex and the hind tibia without the narrow yellowish base. The abdomen (which is detached) has the apex of the

post-petiole and the second tergite almost entirely reddish, and the sixth and following tergites mostly blackish. The male paratype differs from the allotype in having the sixth and following tergites blackish, the hind tibia without a brownish stripe below and the hind tarsi (which are missing, except one basitarsus, in the allotype) yellowish, with the apices of segments very narrowly pale brownish.

Group XII *(ocellata).*

63. **Campoplegidea ocellata** n. sp.

In its modest size, stout body, shining mesopleura, short and stout legs, weakly compressed abdomen and general colour, this species resembles *pulchella* from which it may be distinguished readily by the receding temples, narrow malar and ocellocular spaces, dullish mesoscutum and conspicuously yellow scape.

Female—Length 9.5 mm. Temples gradually receding, strongly rounded behind; malar space scarcely one-fourth basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-third basal width of latter; ocellocular space one-half diameter of lateral ocellus; face, including clypeus, as broad as long, dullish and densely rugoso-punctate, with short, dense, whitish pubescence; front dullish, finely roughened, bearing a median vertical carina. Mesoscutum mat, densely, shallowly punctate; mesopleura rather coarsely, densely punctate, polished between punctures and on speculum; prepectoral carina distinct in lateral sections; scutellum shining at base, rather dull beyond, densely punctate on apical half, disk convex and margined by carinae on basal half; propodeum rather short and broad, median longitudinal sulcus distinct, dorsum evenly rounded to sides, basal transverse carina distinct at middle, its lateral arms short, apical carina absent; propodeum finely, irregularly rugulose, with indistinct, shallow punctures, basal angles more feebly sculptured and somewhat shining, vestiture short and rather dense; areolet rather narrow and oblique, second recurrent received distinctly beyond middle; nervulus post-furcal by about one-half its length; legs stout, front femora somewhat swollen, claws with five or six strong teeth. Petiole and post-petiole rather stout, latter broad and slightly depressed, former without grooves or foveae; second tergite short, three-fifths as broad at apex as long, spiracle only slightly beyond middle and about five times its diameter from lateral margin; gastrocoeli small and broadly oval; abdomen only moderately compressed; sheath broad, subtruncate at apex.

Head, thorax and propodeum black; antennae black, scape yellow below, flagellum brownish on apical half; mandibles and palpi pale yellow; coxae black, the anterior pair with apices narrowly yellow; remainder of front legs yellow; middle legs largely yellow beyond coxae, but trochanters and femora marked with brownish behind, and two or three apical segments of tarsi pale yellowish-brown; hind trochanters blackish, hind femora dark reddish, latter outwardly and basally somewhat suffused with blackish; hind tibia brownish-black, former with a sordid yellowish stripe on basal

two-thirds of posterior surface; calcaria sordid yellow; tegulae yellow; veins and stigma brown; petiole black, post-petiole blackish with the apex somewhat rufo-piceous; remainder of abdomen reddish, except second tergite which is blackish at base; sheath black.

Holotype—♀, Victoria, Tex., Jan. 16, 1913, (J. D. Mitchell). In United States National Msueum.

Group XIII *(egregia).*

This is a very distinct group characterized as follows: size small (length 9–10 mm.); eyes scarcely emarginate; temples dimorphic (strongly rounded and feebly receding in male; weakly rounded and moderately receding in female); petiole cylindrical, polished, without foveae and of a yellowish hue; lateral margins of third tergite sharply inflexed; second discoidal cell strongly narrowed at base.

The two following groups, which also have the third tergite with inflexed lateral margins, differ widely in most other respects from each other and from the present group. The *egregia* group is one of the most distinctive in the genus and does not seem to be closely allied to any other.

64. **Campoplegidea egregia** (Vier.)

Viereckiana egregia Viereck, Proc. Biol. Soc. Wash., XXIX, 167, 1916.

Type—Type female from Virginia, in Museum of Comparative Zoology.

In several respects this species resembles *brachiator* but differs from it as noted in the discussion thereunder.

Female—Length 9–10 mm. Temples only feebly rounded and moderately receding; head rather thick antero-posteriorly; malar space three-eighths basal width of mandible; junction of occipital and hypostomal carinae slightly before base of mandible; ocellocular space one and one-third times as great as diameter of lateral ocellus; eyes very weakly emarginate on inner margins opposite antenna; clypeus feebly convex; face including clypeus, rather narrow, distinctly longer than broad (60 : 44). Mesopleura shallowly, rather sparsely punctate, shagreened between punctures; speculum more shining; an irregular, somewhat foveolate impression extending from mesopleural fovea to prepectoral carina, the latter well defined laterally and extending to margin of mesopleuron; mesoscutum and scutellum dullish, the latter rather small and narrow, its disk margined by carina on basal one-half; propodeum dull, finely, irregularly rugulose, dorsal surface flattened or very feebly concave, rounded to sides; propodeal spiracles short-oval; basal carina of propodeum distinct, its lateral portions stronger and curving forward in direction of spiracles; apical carina present only on sides of propodeum; areolet moderate in size, second recurrent received distinctly before middle; second discoidal cell strongly narrowed at base; nervulus post-furcal by nearly one-half its length. Petiole polished, cylindrical; second tergite slender, elongate, gastrocoeli slightly before middle; third tergite with lateral margins inflexed; sheath slender.

Head, thorax, propodeum and coxae, black; scape and pedicel yellow, with brownish stripe above; mandibles except tips, palpi, tegulae, front and middle legs beyond coxae (except yellowish-stramineous tarsi), yellow; hind legs reddish beyond coxae, their tibiae narrowly yellowish at base behind; wings with pale brownish tinge, apices more heavily infuscate, veins and stigma pale brown; petiole yellowish to pale stramineous, shading to reddish on the post-petiole; abdomen reddish beyond first segment; sheath brownish.

Male—Departs from the structure of the female in having the temples strongly rounded and not distinctly receding for some distance behind eyes; otherwise very similar to female in structure and colour.

Distribution—Pa.: Inglenook (Dauphin Co.), N. Bloomfield; Va.: Great Falls; Md. Cabin John, Glen Echo, Plummers Isd.; D.C.: Georgetown; Ohio: Wooster; Tex.: Austin.

Group XIV *(rufescens).*

65. **Campoplegidea rufescens** n. sp.

Plate III, Fig. 1

This species stands alone in the combination of characters employed in the key. Except for the inflexed margins of the third tergite it is very unlike the *egregia* and *nigerrima* groups. In colour it closely resembles some specimens of *vitticollis*, which species, however, belongs to a quite different structural group. The form and sculpture of the mesoscutum, scutellum and propodeum are somewhat similar to *pallescens*.

Female—Length 12 mm. Temples feebly rounded, strongly receding; malar space scarcely one-third basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible four-fifths basal width of latter; ocellocular space two-thirds diameter of lateral ocellus; face, including clypeus, distinctly longer than broad (42 :.35); front slightly concave, dullish, rather evenly roughened, with fine, median, vertical carina. Mesopleura evenly, rather densely punctate, with fine, reticulate sculpture between punctures; lateral portions of prepectoral carina strongly elevated and broadly curved to anterior margin of mesopleuron; mesoscutum dull and densely punctate; scutellum rather small, disk margined by carina only at basal angles; sides of scutellum conspicuously hairy; propodeum with a strong, median, longitudinal sulcus; basal traverse carina of propodeum distinct, its apices more strongly elevated and curved towards spiracles; propodeum beyond basal carina with numerous, rather strong, transverse, irregular, anastamosing rugae which transverse the median sulcus, spaces between rugae and region before basal carina finely, irregularly wrinkled; areolet of moderate size; nervulus slightly post-furcal, petiole polished, cylindrical, without foveae; post-petiole distinctly broader than petiole; second tergite elongate, gastrocoeli at middle; lateral margins of third tergite inflexed in basal two-thirds; sheath narrow at base, apex rounded.

Reddish-brown, with head, flagellum, mesosternum and median stripe on mesoscutum, black; scape and pedicel reddish-brown; mandibles except tips, palpi, anterior surface of front femora, front and middle tibiae

and tarsi, yellowish, the latter with apical two or three segments stramineous; coxae brownish, the middle and hind pairs and their trochanters, blackish below; middle and hind femora reddish-brown, darker below; hind tibiae and tarsi dark brownish, the former with a conspicuous pale yellow stripe occupying posterior and outer surface except at apex; tegulae pale brown; second tergite with crest blackish except at apex; sheath dark brown; stigma and veins light brown, membrane tinged with brown, apex of wing more distinctly brownish.

Male—Length 11 mm. Essentially as in female.

Holotype—♀, Cabin John, Md., July, 1917, (R. M. Fouts).

Allotype—♂, Cabin John, Md., July 15, 1917, (R. M. Fouts).

Paratypes—1 ♂, 4 ♀♀, Cabin John, Md., July–Aug. 27, 1917, (R. M. Fouts); 2 ♀♀, Kanawha Sta., W. Va., June 26, 27, 1918, (S. A. Rohwer); 2 ♀♀, Rosslyn, Va., (H. H. Smith); ♀, Vienna, Va., June 4, 1911, (R. A. Cushman); ♂, Dixie Landing, Va., May 27, (C. L. Marlatt); ♀, Georgetown, D.C., (H. H. Smith); ♀, Rancocas Park, N.J., July 21, 1927, (J. K. Holloway); ♂, 2 ♀♀, Glenside, Pa., Aug. 19, 24, 1934, (G. B. Sleesman); ♂, Morrisville, Pa., Aug. 20, 1932, (G. B. Sleesman); ♀, Onaga, Kan., (Crevecoeur); ♀, Iowa, June 15, 1934, (H. E. Jaques).

Type series in United States National Museum. Paratypes, No. 4921, in Canadian National Collection.

Group XV *(nigerrima)*.

The two following species constitute a group conspicuous because of the uniformly black colour and the unusually long ovipositor and sheath in the female. Additional distinctive characters are the inflexed margins of the third tergite, the well defined, basal, propodeal carina which terminates on a slight tumidity on either side, the large, very broad areolet and the apical infuscation of the wings.

66. **Campoplegidea nigerrima** (Vier.)

Plate II, Fig. 8.

Anisitsia nigerrima Viereck, Proc. U. S. N. M. 43, 583, 1912.
C. (Viereckiana) nigerrima Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 173, 1926.

Type—Female, Priest Lake, Idaho, in United States National Museum.

Female—Length 13–14 mm.; sheath 2.5 mm. Temples rather strongly rounded, distinctly receding; malar space one-half basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible one-half basal width of latter; ocellocular space two-thirds diameter of lateral ocellus; face, including clypeus, only slightly longer than broad; facial vestiture indistinctly parted; antennae rather short and stout, especially scape and pedicel. Mesopleura finely punctate and polished, only the lowest portion with distinct sculpture between punctures; lateral sections of prepectoral carina absent, median portion continuous with margin of coxal scrobe; mesoscutum opaque, finely sculptured and densely

punctate; notauli indicated by difference in sculpture anteriorly; scutellum densely punctate, convex, rather narrow, disk not margined laterally by carina except at extreme base; propodeum rather narrow and elongate, median sulcus broad, dorsal surface sharply rounded to sides; basal carina distinct, its apices curved forward towards spiracles and surmounting a slight eminence; region beyond basal propodeal carina finely, transversely rugulose, the rugulae sometimes broken and more or less confused; apical carina present on sides, with several strong rugae of similar character beyond; apex of propodeum extending a little beyond middle of dorsal surface of hind coxae; areolet large and very broad, second recurrent almost straight, received by areolet distinctly before middle; nervulus post-furcal by one-half its length. Petiole polished, without fovea; post-petiole much broader than petiole; basal half of lateral margins of third tergite inflexed; sheath as long as petiolar segment, broadest a little beyond middle, apex rounded; ovipositor correspondingly long, stout, very slightly upcurved.

Black, with palpi, front femora and tibia anteriorly, and to a lesser extent middle tibia, dark reddish-brown; wings with brownish tinge, apex usually distinctly infuscated.

Distribution—IDAHO: Priest Lake (type). Five females have been studied from the following localities: CALIF.: Berkeley, Carmel; B.C.: Bear Lake.

67. **Campoplegidea luctuosa** (Prov.)

Campoplex luctuosus Provancher, Nat. Can., VII, 145, 1875, Pet. Faun. Ent. Can., 362, 1883.
C. (Viereckiana) luctuosa (Prov.), Viereck, Trans. Roy. Soc. Can. XX, Sec. V, 173, 1926.

Type—Female (without head) No. 335 in Quebec Public Museum.

The type is the only known specimen of this species. It is exceedingly similar to *nigerrima* and can be separated from that species only by the characters mentioned in the key. The ratio between the longer calcarium and the basi-tarsus of the hind tibia is 19 : 55 in *luctuosa*.

Group XVI *(pallescens)*.

68. **Campoplegidea pallescens** n. sp.

At once distinguished from all other species here treated by the absence of any black on the head and thorax, the entire body being light reddish-brown with the anterior aspect of the head, and the legs, in part, pale yellowish. Distinctive structural characters are found in the unusually narrow malar and ocellocular spaces, strongly post-furcal nervulus, narrow post-petiole and slender, rather elongate sheath.

Female—Length 10 mm. Temples broadly curved, strongly receding; malar space scarcely one-fourth basal width of mandible; occipital and hypostomal carinae uniting very slightly before base of mandible; ocellocular space one-third diameter of lateral ocellus; face slightly narrowed

below; face, including clypeus, distinctly longer than broad (6 : 5); front punctate laterally, finely rugulose medianly above antenna, with fine, median, vertical carina; inner margins of eyes rather strongly emarginate opposite antennae. Mesopleura coarsely, densely punctate, speculum finely rugulose; prepectoral carina not extending to margin of mesopleuron; coxal scrobe distinct; mesoscutum and scutellum, especially the former, dull and densely punctate, the latter rather short, broad at apex, disk not margined by carina except at basal angles; propodeum rather coarsely punctate and transversely rugose, especially on posterior portion; median, longitudinal, propodeal sulcus moderately broad, strongly impressed, sulcus strongly, transversely costate except at base; basal, transverse carina of propodeum distinct, apices curving forward in direction of spiracles, apical carina not distinguishable from rugae. Areolet moderately large, rather broad; second recurrent straight, joining areolet at middle; nervulus post-furcal by very nearly its own length. Petiole polished, cylindrical, entirely without foveae; post-petiole, viewed from above, scarcely broader than petiole; sheath one-half as long as petiolar segment, apex rounded.

Pale reddish-brown except as follows: flagellum dark brown; front except median reddish spot above antennae, face, clypeus, mandibles except tips, palpi, scape, base of pedicel, genae, posterior orbits, front legs except base of coxae and femora behind, narrow apex of middle femora and beyond, pale yellowish; second tergite with blackish side line and a brownish streak on crest except at apex; sheath dark brown; stigma and veins pale brown; membrane faintly tinged with brown, the apex of the wing more distinctly brownish.

Holotype—♀, Georgia (Coll. T. Pergande). In Collection of United States National Museum.

Group XVII *(villosa).*

69. **Campoplegidea villosa** (Nort.)

Campoplex villosus Norton, Proc. Ent. Soc. Phil., I, 365, 1863.
Anisitsia villosa (Nort.) Viereck, Proc. U. S. N. M., XLII, 632, 1912. (Genotype.)
C. (Viereckiana) villosa (Nort.) Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 173, 1926.

Type—Peabody Museum of Natural History, Yale University, New Haven, Conn.

Distinctive in having the propodeum smooth and shining on either side before the basal transverse carina, the latter well defined, its apices strong and curved toward spiracle and surmounting a slight tumidity in this region. Other noteworthy characters are: the strongly receding temples; small, immargined and laterally pilose scutellum; the narrow, regularly rugulose propodeum and the more or less extensive reddish markings on the thorax, propodeum and coxae.

Resembles *nigerrima* and *luctuosa* somewhat in the form of the propodeum, its sculpture and basal carina, but with the lateral margins of third tergite not inflexed, the sheath and ovipositor short and the abdomen reddish. Agrees with *major* and its allies in the elongate, basal, propodeal carina, the laterally pilose scutellum and rather large areolet.

Somewhat similar in colour to *rufescens* but with thorax more extensively blackish and third tergite not inflexed laterally. Very similar in colour to *vitticollis* for which reason the two species have sometimes been confused in collections. They pertain, however, to different structural groups and may be distinguished easily by the characters employed in the key.

Female—Length 15–17 mm. Temples feebly rounded, very strongly receding; malar space one-fourth to almost one-third basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible two-thirds basal width of latter; ocellocular space approximately one-half diameter of lateral ocellus; face, including clypeus, distinctly longer than broad; front weakly concave, with fine, vertical carina; face and thorax, especially scutellum and propodeum, with conspicuous, rather long, whitish vestiture. Thorax rather narrow; mesopleura shining, punctures not dense, for the most part separated by intervals two or three times their own diameter, intervals very weakly sculptured or smooth; prepectoral carina terminating on mesopleuron well above level of base of front coxae, not curved to margin; mesoscutum dullish, densely punctate, median lobe rather prominent; notauli indicated in front by broad shallow impressions; scutellum small, narrow, convex, disk not carinately margined; mesoscutal carina terminating in a distinct lobe on either side at basal angles of scutellum, scutellum densely punctate and pilose especially on sides; propodeum shining, rather regularly, transversely rugulose beyond basal carina; apical carina represented laterally by one of a number of stronger rugae; vestiture of propodeum rather long and conspicuous; areolet large, broad; second recurrent bent inwards at bulla, received close to middle of areolet; nervulus post-furcal by two-thirds its length. Petiole polished, cylindrical, without fovea; sheath short, rather slender, rounded at apex.

Head and thorax black, the latter and propodeum varied with reddish; metapleura usually largely reddish, this colour sometimes extending on the most posterior portion of the mesopleura; propodeum varying from reddish, with only the base black, to black except at apex; middle and hind coxae usually more or less reddish, occasionally entirely black, in the latter case hind femora also black and hind tibia blackish except for a yellowish stripe; front and middle femora yellowish apically, their bases suffused with reddish and fuscous; tibia and tarsi of four anterior legs yellowish, apical one or two tarsal segments brownish; hind tibia brownish-black with an elongate, yellowish stripe posteriorly; hind tarsi brownish to black; palpi, mandibles and tegulae yellowish, palpi with apices sometimes brownish and tegulae more or less infuscated behind; abdomen reddish, crest of second tergite black except at apex; sheath blackish; wings faintly dusky.

Male—Structure essentially as in female. Differs from the female in colour principally in having the front and middle legs more extensively yellowish.

Distribution—Fairly common in the eastern portion of Canada and United States, occurring also in British Columbia and Oregon. One quite typical specimen is at hand from the White Mountains of New Mexico (alt. 8,000 ft.). Provinces and states represented in the material before me are: Ont., Que., Man., B.C., Md., N.J., Pa., Va., W. Va., Ore., and N. Mex. The type localities are New York and Connecticut.

Group XVIII *(major)*.

The four species which follow form a compact group having the following characteristics. Size large (length 16–18 mm.); head thin antero-posteriorly; temples feebly curved, strongly receding; front concavely depressed, with fine, median, vertical carina; malar space one-third to almost one-half basal width of mandible; ocellocular space usually slightly less than diameter of lateral ocellus; face broad, including clypeus, only very slightly longer than broad (50 : 45); mesonotum mat, shallowly, densely punctate; scutellum narrow, convex, immargined, shining and densely punctate, densely pilose especially on lateral surfaces; mesopleura polished, densely punctate, prepectoral carina terminating well above level of base of front coxae and not curved to margin; propodeum broad, rounded between sides and dorsal surface, median sulcus broad and deep; basal, transverse, propodeal carina well defined, its apices more strongly elevated and sharply bent forward in direction of spiracle, the latter long and very narrow; propodeum densely punctate on either side before basal carina, beyond with a confusion of numerous, shallow, poorly defined punctures and irregular, transverse rugulae; apical carina usually distinct on sides of propodeum; vestiture of propodeum long and fairly dense; areolet large, moderately broad; petiole polished, cylindrical, very gradually enlarging to post-petiole; petiolar foveae absent; gastrocoeli of second tergite at basal one-third, spiracle at about apical two-fifths; sheath of normal length, slender.

Head, thorax and propodeum black; abdomen reddish, petiolar segment usually stramineous to pale reddish, with post-petiole often somewhat fuscous above; dorsal portion of second tergite more or less fuscous; sheath blackish; wings smoky-yellowish tinged; legs yellow and blackish.

The four species below are separable into two sub-groups dependent on whether the occipital and hypostomal carinae unite much before or at the base of mandible. Beyond this they do not offer good structural distinguishing characters.

70. **Campoplegidea robusta** n. sp.

Female—Length 18 mm. Junction of occipital and hypostomal carinae distant from base of mandible two-thirds basal width of latter.

Tegulae yellow, with outer posterior portion brown; coxae black, anterior pair with a yellow spot at apex; front trochanters and front femora, except for dark brownish mark on posterior surface of latter, front and middle tibia and tarsi, except brownish apical segment of latter, anterior surface of middle femora, stripe on basal three-fourths of posterior surface of hind tibia, yellow; middle and hind trochanters, middle femora except anteriorly, hind femora and posterior surface of hind tarsi, blackish; hind tibia except for yellow stripe, and hind tarsi below, dark brown; hind calcaria sordid yellowish; petiole stramineous; post-petiole reddish-stramineous, darker above.

Male—Agreeing with female in all essential details.

Holotype—♀, Hocking Co., Ohio.

Allotype—♂, Mt. Holly Springs, Pa., July 7, 1918, (R. M. Fouts).

Paratypes—♂, Palisades, N.J., July 3, 1918; ♀, Mass. (Bowditch).

Types in United States National Museum. Paratype, No. 4922, in Canadian National Collection.

71. **Campoplegidea conformis** n. sp.

Agreeing in every respect with the characters assigned to *robusta* except as noted in the key.

Holotype—♀, Palmerlee, Ariz., January, (N. Banks). In Collection of Museum of Comparative Zoology, Boston, Mass.

72. **Campoplegidea major** (Cress.)

Plate III, Fig. 10.

Campoplex major Cresson, Proc. Acad. Nat. Sci. Phila., 369, 1878.
C. (Viereckiana) totalis Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 173, 174, 1926. (New Synonymy).

Types—The type of *major* is a female from Vancouver Isl., B.C., No. 1556 in the Academy of Natural Sciences, Philadelphia. The type of *totalis* is a female from Aylmer, Que., No. 1530 in the Canadian National Collection.

The writer has not seen the type of *major* but through the kindness of Mr. W. J. Brown has obtained detailed notes regarding it. Also at hand is a specimen compared with the type of *major*, by Mr. Brown, and found by him to agree in all particulars with the type. This specimen, which is from Merivale, Ont., agrees with the type of *totalis* and with other specimens of the species from Eastern Canada. On this evidence the above synonymy is proposed.

In this species the occipital carina does not join the hypostomal carina before the base of mandible. In other structural characters and in colour it is exceedingly similar to *robusta*, differing only in having the petiole reddish rather than stramineous and the middle trochanters with a narrow yellowish stripe in front.

In addition to the above mentioned localities, two females are at hand from Ste. Agathe des Monts, Que., and a male from Melrose Highlands, Mass. I have also examined a male from the collections of the United States National Museum, bearing the data, Hells Canyon, N. Mex., Sept., 1916, (C. H. Townsend), which I refer to this species, there being only a few very slight differences in sculpture and colour.

73. **Campoplegidea magnifica** n. sp.

Differing from *major* only as noted in the key.

Holotype—♀, Onteora Mt., Greene Co., N.Y., July 5–10, 1930, (L. O. Howard).

Allotype—♂, same data as holotype, (July 15–20).

Paratypes—♀, same data as allotype; ♀, Pyziton, Clay Co., Ala. (H. H. Smith).

Types in United States National Museum. Paratype, No. 4923, in Canadian National Collection.

Group XIX *(brachiator).*

Because of several unusual features, namely the strongly basally narrowed second discoidal cell; narrowly sulcate propodeum; recurved, basal, propodeal carina and the cylindrical, polished, yellowish petiole, *brachiator* is placed in a separate group. The group, although distinctive, appears best placed among those in which the areolet is rather large and broad, and the basal propodeal carina recurved at its apices.

The strongly narrowed second discoidal cell and the yellowish petiole are suggestive of the *egregia* group which differs markedly, however, in having the margins of the third tergite sharply inflexed, eyes scarcely emarginate and the temples dimorphic in form.

74. **Campoplegidea brachiator** (Say)

Ophion brachiator Say, Boston Jl. Nat. Hist., I, 240, 1835, (Leconte ed. II, 695).
Campoplex xanthogaster Brullé, Hist. Nat. Inst. Hym., IV, 159, 1846.
Viereckiana brachiator (Say) Cushman and Gahan, Proc. Ent. Soc. Wash., XXIII, 168, 1921.

Types—The type of *brachiator* is lost and the type of *xanthogaster* is probably in an European museum. The Cushman and Gahan neotype of *brachiator* is in the United States National Museum.

The following description of the female is drawn from the series before me, including the neotype of *brachiator*.

Female—Length 10–11.5 mm. Temples feebly curved, very strongly receding; malar space one-half basal width of mandible; junction of occipital and hypostomal carinae remote from base of mandible three-fourths basal width of latter; ocellocular space slightly less than diameter of lateral ocellus; face, including clypeus, distinctly longer than broad; front with a fine, median carina. Mesopleura feebly shining, finely sculptured between punctures, less distinctly so on speculum; scutellum rather narrow, convex, disk dullish with fine, shallow punctures, lateral margins of disk carinate except near apex; vestiture of scutellum and propodeum rather dense; propodeum with apex extending to apical one-third of dorsal surface of coxae; dorsal surface of propodeum rather flat, with a narrow, median, longitudinal sulcus; basal propodeal carina well defined, apices rather strong and curved forward in direction of spiracle; propodeal spiracles narrow and elongate; apical carina distinct only on

sides of propodeum; sides and dorsum of propodeum irregularly, transversely rugulose-punctate, rugae stronger and more regular, apically, on portion above coxae; areolet rather large and broad, second recurrent at middle and almost straight; second discoidal cell strongly narrowed at base; nervulus post-furcal by about one-half its length. Post-petiole slightly depressed, very gradually enlarged from petiole; spiracle of second tergite slightly before apical one-third; third tergite with lateral margins not inflexed; sheath slender.

Head, thorax, propodeum, middle and hind coxae and crest of second tergite except at apex, black; scape and pedicel yellow with a brownish stripe above; flagellum varying from brownish to almost black; mandibles except apices, palpi, tegulae, front legs except coxae at base and behind, middle tibia and tarsi at base and anteriorly, yellowish; middle tarsi pale brownish behind; middle and hind trochanters and femora reddish-brown suffused with darker brown toward base; hind tibia reddish-brown; petiole yellowish at base shading to stramineous beyond, post-petiole largely brownish-stramineous; abdomen rather pale reddish; sheath brownish; stigma and veins brown, membrane pale brownish tinged.

Male—Structure and colour very similar to female.

Distribution—Three males and four females have been examined from the following localities: Mass.: Wilbraham; Va.: Rosslyn; Ga.: Atlanta; Ala.: Pyziton (Clay Co.); Que.: Franklin, Knowlton.

Group XX *(johnsoni)*.

75. **Campoplegidea johnsoni** n. sp.

The four following species agree with the *major* group in having the scutellum densely pilose laterally and the areolet large and broad. In the present group the basal carina of the propodeum is elongate and recurved at its apices, though sometimes it is weak in the apical portions. The species in the *johnsoni* group are decidedly smaller than those of the *major* group and the propodeum is less regularly transversely rugulose.

Johnsoni is easily distinguished from the three following species in having the occipital and hypostomal carinae not uniting before the base of mandible.

Female—Length 11.5 mm. Temples nearly flat, strongly receding; malar space slightly more than one-fourth basal width of mandible; ocellocular space slightly less than diameter of lateral ocellus; face, including clypeus, scarcely longer than broad. Thorax rather densely and coarsely punctate; mesopleura polished between punctures; prepectoral carina terminating well above level of base of front coxae, not curved to anterior margin of mesopleuron; median lobe of mesoscutum prominent; notauli very short; mesoscutum somewhat shining, punctures dense and often confluent; scutellum narrow, convex, shining, densely punctate; propodeum rather shining, with long, conspicuous vestiture; median propodeal sulcus deep, strongly transversely rugose; basal propodeal carina well defined, its apices weaker and curved forward; sculpture of propodeum consisting of numerous, rather strong, irregular, obliquely

transverse rugae, confused by numerous, shallow punctures, rugae on apical portion stronger than in other regions; areolet large, broad, recurrent vein received before middle; nervulus post-furcal by two-thirds its length. Petiole polished, cylindrical, very gradually enlarging to the rather narrow post-petiole; sheath slender.

Black except as follows: base and apex of mandibles brownish, intermediate portion yellow; palpi yellowish, darker at tips; tegulae yellowish; front trochanters brownish-black; front femora mostly reddish, paler at apex and in front, with brownish suffusion at base; middle femora blackish, anterior surface and apex reddish-brown; front and middle tibiae and tarsi yellow, apices brownish; hind femora largely blackish, apices reddish-brown; hind tibia and tarsi dark brownish-black; calcaria brown; wings faintly dusky, with a slight cloud at apex; abdomen reddish; crest of second tergite and sheath, blackish.

Holotype—♀, Nantucket, Mass., July 25, 1928, (C. W. Johnson).

Paratype—♀, Staten Isl., N.Y.

Type in United States National Museum. Paratype, No. 4924, in Canadian National Collection.

Notes—The paratype agrees with the type except for its smaller size (length 10 mm.) and paler leg colour. In it the front femora are paler reddish, becoming almost yellow anteriorly and at apex; the middle femora are dull reddish, darker at base, with the apex yellowish; the hind femora are bright reddish except for a slight duskiness at the base.

76. **Campoplegidea fuscitarsis** Vier.

Plate II, Fig. 11.

C. (Viereckiana) fuscitarse Viereck, Trans. Roy. Soc. Can., XX, Sec. V, 173, 175, 1926.

Type—Female (without locality data); No. 1522 in the Canadian National Collection.

This species and the two following differ from *johnsoni* in having the occipital and hypostomal carinae united distinctly before the base of mandible, the point of junction being distant from base of mandible one-half to three-fourths basal width of latter. *Fuscitarsis* differs further from *johnsoni* in its slightly less strongly receding temples, more finely sculptured and more opaque mesoscutum, broader scutellum, slightly longer sheath and dark brown or blackish tegulae. It differs from *ellopiae* and *quebecensis* in the prominently lobed mesoscutal carinae and also from the former in the less strongly receding temples, more evenly, less densely punctate mesopleura and the entirely black propodeum. *Quebecensis* differs from *fuscitarsis* in having the mesopleura more finely punctate, the basal propodeal carina developed only slightly at the middle, the propodeum somewhat narrowed, less coarsely sculptured and with shorter vestiture.

The present species presents quite a little variation in both sculpture and colour. The mesopleura are moderately, densely punctate, the punctures for the most part separated by intervals equal to their own diameter, the intervals entirely smooth or minutely sculptured. The

mesoscutum is mat, with fine, dense punctures. The basal propodeal carina varies from being strong, with its apices distinct and curved forward in the direction of the spiracles, to rather weak, with the apical curved portions only feebly defined; beyond the basal carina the propodeum is shining, with irregular, anastamosing rugulae and ill-defined punctures. The vestiture of the head, thorax and propodeum is rather long and fairly dense; in some specimens the facial vestiture is somewhat parted, but not as distinctly so as in the *vitticollis* group. The areolet is unusually broad and large, with a distinct petiole. In other respects the structure conforms closely with the description given for *johnsoni*.

The type of *fuscitarsis* agrees in colour with the description of *johnsoni* except as follows: maxillary palpi brownish; front and middle tibiae reddish behind; hind tibia reddish-brown, posteriorly with a dull paler stripe extending from base to slightly beyond middle; tegulae dark brown; petiole dusky on upper surface. In the series at hand the colour of the hind tibiae varies from dull reddish to almost black with the paler stripe absent; the hind femora also vary from brownish-black, with apices more reddish to entirely black; in the latter case the corresponding portions of the front and middle legs are more blackish.

Distribution—The type, which is without data, is stated by Viereck to be from Ottawa, Ont. In addition, one male and six females are at hand from the following localities: Mass.: Mt. Greylock; Vt.: McKillington, Rutland 4,000 ft.; N.Y.: Old Forge; Que.: Brome, Kazubazua; Ont.: Constance Bay, Mer Bleue (Ottawa).

77. **Campoplegidea ellopiae** Wly.

Plate II, Fig. 12.

C. (Viereckiana) ellopiae Walley, Can. Ent., LXI, 22, 1929.

Type—Female, Footes Bay, Ont., No. 2906 in the Canadian National Collection.

Very similar to *fuscitarsis*, the principal distinguishing characters being given in the key and in the discussion under *fuscitarsis*.

The following characteristics are noteworthy in this species: temples strongly receding; ocellocular space distinctly less than diameter of a lateral ocellus; occipital and hypostomal carinae with junction distant from base of mandible fully three-fourths basal width of latter. Mesopleura shining, coarsely, densely punctate, intervals usually narrower than diameter of punctures, punctures often confluent; areolet broad, rather short antero-posteriorly.

Differs in colour from *fuscitarsis* principally in having the palpi and tegulae pale yellow, the hind tibia with a conspicuous, pale yellowish stripe on posterior surface, almost forming an annulus at the middle and extending to the apical one-fourth; also with petiolar segment uniformly reddish and the apex of the propodeum reddish in lateral aspect.

Distribution—Known only from the type series from Footes Bay, Ont.

Host—Ellopia fiscellaria Gn.

78. **Campoplegidea quebecensis** n. sp.

Plate II, Fig. 13.

Resembles *johnsoni* but with occipital and hypostomal carinae uniting distinctly before base of mandible. Mesopleura more finely punctate than in *ellopiae* and *fuscitarsis*, propodeum also more elongate with shallower median sulcus, finer sculpture and shorter basal carina than in those species. Lacks the distinct, pale, hind tibial stripe found in *ellopiae;* also tegulae yellow with brownish apices, not uniformly dark as in *fuscitarsis*.

Female—Length 11 mm. Temples moderately rounded, rather strongly receding; malar space one-third basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible fully one-half basal width of latter; ocellocular space slightly less than diameter of lateral ocellus; face, including clypeus, as long as broad. Mesopleura shining, finely punctate, punctures separated by intervals a little greater than their diameter; mesoscutum mat, shallowly, densely punctate; scutellum narrow, densely punctate, densely pilose laterally; propodeum rather narrow, evenly rounded from sides to dorsal region, median sulcus distinct but not deep, basal carina developed only at middle; surface of propodeum finely, irregularly rugulose, somewhat shining, with short, but rather dense vestiture; areolet large and broad, second recurrent received before middle; nervulus post-furcal by three-fourths its length.

Black except as follows: mandibles yellow except at base and apex; palpi yellow with apex brownish; tegulae yellow, shading to brown posteriorly; legs blackish, paler as follows: spot at apex of front coxae, anterior margin of front trochanters and front femora, entire front tibia and tarsi except apex of latter, apices of middle femora, middle tibia except inner surface, yellow; middle tibia inwardly and middle tarsi, brownish; hind tibia reddish-brown, shaded with blackish inwardly and behind; hind tarsi dark brown, basal segment paler at base; calcaria brown; wings pale dusky, slightly darker at apices; abdomen reddish, petiolar segment above and crest of second tergite, blackish; sheath blackish.

Holotype—♀, Knowlton, Que., July 11, 1936, (G. S. Walley); No. 4509 in the Canadian National Collection, Ottawa, Ont.

Paratypes—♀, Sweetsburg, Que., July 7, 1936, (G. S. Walley); ♀, Hinsdale, Mass., July 20, 1928, (Gipsy Moth Lab. No. 12164N81) ex *Orthofidonia semiclarata*. Second paratype in United States National Museum.

Host—*Orthofidonia semiclarata* Wlk.

Note—The paratype from Sweetsburg, Que., agrees with the type except for its smaller size (length 9.5 mm.).

Group XXI *(vitticollis)*.

79. **Campoplegidea vitticollis** (Nort.)

Campoplex vitticollis Norton, Proc. Ent. Soc. Phila., I, 365, 1863.
Anisitsia vitticollis (Nort.) Viereck, Proc. U. S. N. M., XLII, 632, 1912.
Casinaria (Viereckiana) vitticollis (Nort.) Viereck, Bull. 22, Conn. St. Geol. Nat. Hist. Survey, Pt. III, p. 271, 1916.

Type—Female, Conn., in Peabody Museum of Natural History, Yale Univ., New Haven, Conn.

This species and *pilosa* form a distinct group which may be recognized by the following characters. The facial pubescence is rather dense and evenly parted on either side a vertical line below each antenna; the post-petiole is rather strongly compressed and more or less shagreened; in the male the propodeum is opaque and covered with very dense, short pubescence. In addition the species are moderate to large in size, the areolet is large and broad and the basal carina of propodeum is short and distinct only at the middle.

In colour *vitticollis* is easily confused with *villosa*, presenting somewhat the same variation as that species. The structural characters of the latter, especially the polished basal angles of the propodeum will readily distinguish it. Structurally *vitticollis* agrees with *pilosa* from which it can be distinguished as noted in the key. *Pilosa* is a western species whereas *vitticollis* is common in the east but also is known from southern British Columbia and the higher altitudes of New Mexico.

Female—Length 11–17 mm. Temples broadly rounded, strongly receding; malar space one-fourth to one-third basal width of mandible; junction of occipital and hypostomal carinae distant from base of mandible two-thirds basal width of latter; ocellocular space two-thirds to three-fourths diameter of lateral ocellus; face, including clypeus, slightly longer than broad; front slightly depressed, with a fine, median carina. Mesopleura polished with rather large, dense punctures; speculum with numerous fine rugulae; coxal scrobe distinctly margined; mesoscutum mat, densely, finely punctate; scutellum rather small and narrow, its densely punctate disk not margined by carinae; sides of scutellum densely pilose; propodeum elongate, apex extending to apical one-third of hind coxae; median propodeal sulcus distinct; basal propodeal carina defined only at middle, sometimes with a short oblique section above and posterior to spiracle; apical carina variable, usually defined on sides of propodeum, occasionally extending obliquely forward on either side of median sulcus; sculpture of propodeum consisting of fine, irregular rugulae and poorly defined punctures; vestiture of propodeum rather dense especially on apical portion; claws with five or six strong teeth. Petiole polished, fovea entirely absent; post-petiole distinctly laterally compressed and shagreened, sheath slender.

In this species the head is black with mandibles and palpi yellowish with their apices brownish; the antennae are usually black, but in some specimens the scape is marked with reddish. The tegulae are pale yellow with brownish or blackish apices. Great variation exists in the colour of the thorax, propodeum and legs with respect to the relative amounts of

reddish and black present. In the darkest example the entire thorax and propodeum are black; more commonly there are reddish spots on the sides of the propodeum, metapleura and mesopleura. In the paler specimens these reddish areas become increasingly larger until a condition is reached in which the entire region is reddish; also the pronotum, mesoscutum except a median black stripe and the scutellum are sometimes reddish. In the palest examples the black on the propodeum may be confined to the median sulcus. The darkest examples have the coxae, except a spot at the apex of the anterior, trochanters, middle and hind femora except apex of former, hind tibiae and tarsi, blackish. The hind tibiae bear a conspicuous creamy yellow stripe on their posterior surface. In specimens with the thorax more extensively reddish the blackish tends to be replaced by reddish on the coxae and femora. The front legs are yellowish with the femora more or less blackish posteriorly and the apical segment of the tarsi brown. The middle legs have the apex of the femora, the tibia and tarsi except the last segment, yellowish, the tibia sometimes with a brownish stripe behind. The wings are tinged with brownish, their apices slightly darker. The abdomen is reddish with the second tergite blackish above except at the apex; sheath blackish.

Male—Differs from the female in having the propodeum opaque and with short, very dense, velvety pubescence. The post-petiole is even more distinctly compressed and more strongly shagreened than in the female. The male exhibits the same range of colour variation as the female.

Distribution—Common in northeastern United States and the adjoining Canadian provinces. Specimens are also at hand from southern British Columbia and the White Mountains of New Mexico (alt. 8,000 ft.). The variations in colour discussed above do not appear to be related to geographic distribution. The New Mexico specimens are among the darkest specimens seen, but specimens equally dark are frequently met with among the eastern series. It is noteworthy that the species has much the same range as *C. villosa*.

Hosts—According to Schaffner and Griswold (1934) this species has been reared from *Malacosoma disstria* Hbn. and *Phigalia titea* Cram.

80. **Campoplegidea pilosa** n. sp.

Female—Agreeing in structure with *vitticollis;* differing in colour from that species principally in having the thorax, propodeum, first abdominal segment, coxae (except a spot on the anterior pair) and the hind femora, black. In a few specimens with the ventral and a portion of the lateral regions of the first abdominal segment more or less reddish.

Male—Structure as in the male of *vitticollis;* colour as in female.

Holotype—♀, Cultus Lake, B.C., Oct. 10, 1938, (J. K. Jacob); No. 4510 in the Canadian National Collection, Ottawa, Ont.

Allotype—♂, Independence, Ore., June 6, 1934, (N. P. Larson).

Paratypes—3 ♂♂, Berkeley, Calif., 4-6-1915, (E. P. Van Duzee); ♂, Fairfax (Marion Co.) Calif., April 5, 1915, (C. L. Fox); 3 ♀♀, Carmel, Calif., Sept. 26, 1921, Sept. 6, 1922, July 6, 1925; ♀, Colorado (C. F.

Baker); ♀, Kokanee Mt., B.C., (9,000 ft., on snow), Aug. 10, 1903, (R. P. Currie); ♀, London Hill Mine, Bear Lake, B.C., (7,000 ft., on snow), July 28, 1903, (A. N. Caudell); ♀, Vernon, B.C., Aug. 14, 1907, (D. G. Gillespie); ♀, Cultus Lake, B.C., Oct. 21, 1938, (J. K. Jacob); ♀, (locality ?), Oct. 6, 1897.

Allotype and paratypes in United States National Museum. Paratypes in Canadian National Collection and California Academy of Sciences.

UNRECOGNIZED SPECIES

Campoplegidea alia (Nort.)

Campoplex alius Norton, Proc. Ent. Soc. Phila., I, 367. 1863.

The type of this species is apparently not in the Peabody Museum at New Haven, Conn., and it appears to be lost. I have been unable to recognize the species from the original description, but believe that it pertains correctly to *Campoplegidea*, possibly belonging in or near the *subtilis* group.

Campoplegidea dissita (Nort.)

Campoplex dissitus Norton, Proc. Ent. Soc. Phila., I, 367, 1863.

The type of *dissitus* is a female in the collection of the Museum of Comparative Zoology at Cambridge, Mass. It bears two labels in Norton's handwriting, the first, "L. Saks. Win. Cam. Mus.", the second, "Proc. Ent. Soc. 1863, N367 *dissitus*". In the original description Norton states the type locality to be "Lake Saskatchewan". This locality is not known but possibly refers to somewhere in the vicinity of the Saskatchewan river which flows into Lake Winnipeg.

From notes on the type, secured for me by Dr. L. J. Milne and Mr. W. J. Brown, I strongly suspect that this species will prove to be merely a rather dark specimen of *glauca*, but until this can be definitely established, the synonymy is withheld.

?Campoplex arcticus Curtis

Campoplex arcticus Curtis, Descr. Ins. Capt. Ross sec. voyage, 1831, app. p. 287.

From the brief information contained in the original description, this species does not appear to pertain to *Campoplegidea*, but I cannot be certain to which genus it should be referred.

NOMEN NUDUM

Campoplegidea triangularis Vier.

This is a *nomen nudum* mentioned only in the original description of *Campoplegidea nigritibialis* (Trans. Roy. Soc. Can., XX, Sec. V, 178, 1926).

PRESENT KNOWLEDGE OF BROWNING ROOT ROT OF WHEAT WITH SPECIAL REFERENCE TO ITS CONTROL[1]

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During the last three years it has become generally apparent that browning root rot (*Pythium* spp.) on the spring-wheat crop following fallow is increasing in distribution and severity in the three Prairie Provinces. This disease has been of more or less concern to the farmers of southeastern, south central, central and northern Saskatchewan for upwards of twenty years. Because of its insidious workings underground, its losses are not spectacular and therefore have not caused alarm. Observations have shown that in more recent years the disease has tended to increase in intensity in many scattered points when seasonal conditions favour its reappearance. Its presence has been known to plant pathologists in Manitoba (2) and Alberta (20) for many years, but it was not until 1937 (3) that serious outbreaks of wide distribution were encountered in Manitoba, and not until 1939 that a similar severe outbreak occurred in many parts of Alberta. It seems, therefore, that the increasing economic importance of browning root rot makes it desirable to sum up the present knowledge of the disease with special emphasis on its more important practical aspects.

The root-infecting *Pythium* spp. are known to persist in the soil for many years, probably because of their resistant oospores, and cannot be starved out by any practicable long rotation (27). Control measures are, therefore, based on the development of soil conditions which increase seedling vigour and check the vegetative phase of these root-infecting fungi.

Many new data have been included in this paper, and information from previously published papers (25, 26, 27, 29) from this laboratory has been drawn on freely.

FIELD DEVELOPMENT OF THE DISEASE

Browning root rot of wheat, in contrast to the two other major root rots, Common Root Rot (*Helminthosporium sativum* and *Fusarium* spp.) and Take-all (*Ophiobolus graminis*), is always most severe on the wheat crop following fallow; it may be found on wheat on stubble in slight amounts, but severe authentic cases have never been reported. All the cereals are attacked, but as wheat is the crop which usually follows fallow in the rotation, it is the crop which is most commonly affected. The root rot tends to be worst in those fields which have had only cereals in the rotation over a number of years. It attracts most attention in June when the lower leaves of affected plants turn yellow and then brown, even though ample moisture be present. Affected areas, which are frequently of large extent and situated most commonly where the land slopes gently, stand out conspicuously as yellow to brown patches in contrast to the greener and more

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leafy growth of normal plants. Diseased seedlings have brown, water-soaked lesions on their seminal and crown roots, usually located at the tips (Figure 1). These lesions, as well as many of the finer rootlets, are usually found to be infested with mycelium and oospores of *Pythium* when examined microscopically. Crown-root "burning" caused by high temperatures and a dry, loose, surface soil, should not be confused with *Pythium* damage

FIGURE 1. A wheat seedling affected with browning root rot. Two of the three crown roots and the two uppermost seminal roots are blackened and decayed by the fungus. The first leaf has turned brown and the second leaf yellow at the tip.

which is usually associated with favourable moisture conditions. Infection of the crown and basal leaf sheath is rare. The disease at this critical stage delays growth and reduces the number of culms, but reduction in stand rarely occurs. With the advent of June rains, higher temperature and better growing conditions generally, new crown roots are produced to replace the damaged ones, so that growth in length of the culms, now slightly reduced in number per plant, proceeds almost normally. Thus frequently by the middle of July it is difficult to detect the diseased areas from the roadway, so that one gets the impression that recovery has occurred. But recovery is only partial, for on entering the field the diseased patches are found to be thinner and more weedy because of reduced tillering, and the plants shorter than in normal areas. Towards maturity, differences are again observable from the roadway. The diseased areas are delayed in maturing and stand out as green islands among the ripening healthy zones. This is in contrast to the other root rots of wheat which ordinarily hasten maturity and consequently are conspicuous as bleached, premature, scattered individuals or patches of varying extent. The influence of early reduction in tillers is reflected in the final yield. Farmers have naturally been inclined to attribute unexpectedly lower yields caused by browning root rot to other later apparent causes, such as intense sunshine and drought or even such things as rust and frost (28). Diseased plants have been found to yield 20 to 80% less than normal plants, so that reduction in yield of the whole field may be as high as 10 bushels per acre. Further loss is usually incurred by a reduction in the quality of the grain. Under conditions which favour it, browning root rot can be as severe as common root rot or take-all.

A seedling disease of wheat caused by *Rhizoctonia solani* and having both leaf and root symptoms somewhat similar to those of *Pythium* root rot, has been known in Australia for many years (Samuel and Garrett, 21). Sprague (23) has recently reported *Rhizoctonia* (?) *solani* and *Fusarium* sp. as causing a root rot of spring barley in Oregon in fields extremely low in phosphorus. In our isolation work we have only occasionally obtained strains of *R. solani* from browned roots, but in no instance have they exhibited more than a trace of parasitism to wheat seedlings in pot experiments.

LIFE CYCLE OF THE PARASITES WITH SPECIAL REFERENCE TO PERSISTENCE IN THE SOIL

It was proved by Vanterpool and Truscott in 1932 (29) that browning root rot is caused primarily by several species of *Pythium*. Of these, *Pythium arrhenomanes* and *P. tardicrescens* are now considered of most importance; *P. volutum* and *P. aristosporum* have been much less frequently isolated from affected roots in recent years. Parasitic *Pythium* spp. were shown to be extensively distributed in the soils of Saskatchewan. They are indigenous on native grasses as they have been isolated from wheat seedlings grown in virgin soil, and grasses of fifteen genera including many native forms (27) became infected when grown in browning soil.

The *Pythium* spp. attacking cereals are readily antagonized during their vegetative phase by other soil organisms which thus bring about an intimate enforced association of the parasites with their host plants. This fact has been recognized by Carpenter (4) for sugarcane and by Drechsler (6) for

other species of *Pythium*. The root tissue once parasitized by the virulent species of *Pythium* may be readily invaded by secondary soil organisms. Probably because of several factors, such as the exhaustion of suitable food supplies in the roots, the production of toxic substances by secondary invaders, or by a rise in temperature, the *Pythium* soon goes into its resting, oospore stage. In this resistant condition the fungus is known to be capable of remaining dormant for four years (7) or more (27) in the absence of suitable host plants. Drechsler (6) has described fungi capable of parasitizing *Pythium* oospores. The importance of these oospore-destroying forms in reducing the oospore inoculum in prairie fields is not known; they have not been encountered in several hundred platings of *Pythium*-infected root tips during the last two years. The persistence of *Pythium* oospores in fallowed soil for several years suggests that the oospore-destroying forms are of little or no consequence under such conditions. It might be possible that the oospores of the species concerned require a long maturation or after-ripening period, as has been claimed by Esmarch (8) for the resting spores of *Synchytrium endobioticum*, and that the conditions of fallowing hasten this after-ripening. This may explain the difficulty encountered in germinating the oospores of the *Pythium* spp. attacking wheat. Over-wintering appears to be necessary and then only a small percentage germinates. Another possibility is that the fine rootlets which are frequently filled with oospores are disintegrated by the frequent cultivations during fallow, thus permitting the separation of the oospores from larger pieces of decomposable host tissue where biological activities, prejudicial to the oospores, are likely to be greatest. At the same time a more uniform distribution of the oospore inoculum is effected. The conditions prevailing in the early season on land previously fallowed appear to favour oospore germination. Direct infection by germ tubes may occur, and sporangial formation within the host roots, with subsequent formation of zoospores, may soon follow. Zoospore infections in close proximity to the foci of discharge may become quite general. Infections probably occur during May before the biological activities of the saprophytic flora, which are antagonistic to *Pythium*, become very active. Under certain conditions vegetative hyphae may grow through the soil from one infected root to another or along the surfaces of the roots. It is this phase which is most likely to be influenced by the addition of organic amendments or by other factors influencing the activities of the general soil microflora. It is likely that conditions favouring initial infection and subsequent progress of the disease are different, but they are difficult to separate, especially in a root disease whose active course seldom extends over one month. Because of the poor competitive ability of *Pythium* with the common soil organisms, it is possible that some such condition, as the one outlined above, is necessary to explain the apparent dominance of *Pythium* at the time infection occurs.

Rands and Dopp (19) obtained some evidence that the presence of salicylic aldehyde in the soil increased the susceptibility of sugarcane to attack by *Pythium arrhenomanes*. In experiments with wheat, Graham and Greenberg (13) found that salicylic aldehyde tended to predispose wheat roots to attack by the same fungus. No evidence has as yet been obtained that salicylic aldehyde or similarly acting compounds are present in browning root rot areas in amounts greater than in adjoining healthy areas.

1. *Passive Spread*

Though the fungus completes its life-cycle underground, its resting spores may be blown great distances by the wind during dust storms (*cf.* 5). Samples of drift soil collected at the roadside, from the gutters of houses in Saskatoon, and from the gutters of the University greenhouse, when sown to wheat, proved to be infested with *Pythium* in each instance. This helps to explain why every sample of black, dark brown, and brown field soil tested to date has been found to contain *Pythium* spp. pathogenic to wheat seedlings grown therein. Two peaty soils and some of the podsols examined also carried the pathogens. The lower pH, compact structure, and forest origin of the podsols, are facts which might explain their paucity of *Pythium* inoculum. Flor (9) has pointed out that species of *Pythium* pathogenic to sugarcane are universally present in Louisiana in fields of healthy cane as well as in those infested with root rot. The work of Carpenter (4) and others indicates that the same is true in Hawaii. Run-off water may wash contaminated soil from one place to another and oospores may be washed down cracks in a field when heavy rains follow a long dry spell. Thus Simmonds *et al.* (22) found oospores in wheat roots at a depth of 2 feet. *Pythium* root lesions were found at a greater depth and were more abundant between the 1- and 2-foot levels than lesions of common root rot or take-all.

2. *Active Spread*

Vegetative mycelium will grow along infected wheat roots and from infected roots through the soil for short distances to healthy roots. It is not likely that zoospores serve to disseminate the fungus to great distances through the soil (*cf.* 15), but they probably greatly increase infestation by infecting fine lateral roots which in the aggregate will cause considerable damage.

INFLUENCE OF THE WEATHER

Attempts to elucidate the influence of the weather on the incidence of the disease have been confused by the fact that the species of *Pythium* found associated with the disease have different temperature optima for growth. Thus both the optimum and maximum of *Pythium arrhenomanes* are more then 5° C. higher than those of *P. tardicrescens* (26). This explains why, during the last two seasons, which were below normal in temperature in certain districts, *P. tardicrescens* was isolated more frequently from field material, while from seedlings grown in the greenhouse in soil collected from the same fields, *P. arrhenomanes* was more often obtained. The fact that physiologic races within each species probably have different optima for infection and growth (*cf.* 19) complicates the situation further. This multiplicity of species and races, with probable individual differences in their nutritive requirements, makes more remote the possibility of obtaining a variety of wheat immune to browning root rot. Temperature-tank studies (29) in sterile soil inoculated with *P. arrhenomanes* showed that the disease was favoured by high moisture content and increased with temperature up to 30° C. relative to the controls. In temperature studies with naturally infested field soil, the disease was worst at 25° C., the highest temperature tested. Early spring seeding is therefore recommended. Under field conditions, bright sunshine, high temperatures, and drying winds bring out the disease symptoms suddenly, but

the plants are doubtless infected some time previously, and should different conditions prevail, may show little sign of the disease. Rain at an appropriate time after primary infection may induce abundant zoospore discharge from sporangia in infected roots and result in increased secondary infections. But if the conditions favour rapid plant growth, root infection is reduced. Observations have shown that the disease is worst in seasons of high rainfall, yet in such seasons, stubble, manured, or phosphate fertilized fields in browning districts do not show above-ground disease symptoms.

PLANTS ATTACKED

All varieties of cereals and all forage grasses commonly grown in the province are attacked, but some slight differences in resistance have been observed. The results of Table 3 show that Thatcher and Apex wheat varieties are somewhat more resistant than the others tested. This is supported by two cases of field evidence. On one farm, on adjoining fields, Thatcher and Apex were apparently free from browning root rot, while Marquis showed severe symptoms; and on another farm, in the same field, Thatcher was green while Reward was badly yellowed and its roots severely lesioned. All crops followed fallow. Little precise information is available on varietal resistance in barley, oats and rye. Experiments still in progress have shown that the following species of *Triticum*, which contain 7-, 14-, and 21-chromosome wheats, were all attacked: *Triticum aestivum*, *T. durum*, *T. compactum*, *T. spelta*, *T. polonicum*, *T. turgidum*, *T. timopheevi*, *T. dicoccum*, and *T. monococcum*.

Grasses, both wild and cultivated, serve to perpetuate the root-infecting fungi. *Pythium arrhenomanes* has been isolated from collections of *Agropyron repens* (L.) Beauv., *A. pauciflorum* Hitchc., *Avena fatua* L. and *Setaria viridis* (L.) Beauv. obtained from wheat fields. Of these, *Agropyron pauciflorum* is a native. Dr. G. B. Sandford has also submitted specimens of *Avena fatua* attacked by *Pythium* which were collected in Alberta. Below is listed the graminaceous species which became infected when grown in naturally infested field soil in each of two years (Table 1).

TABLE 1.—GRASSES GROWN IN FIELD SOILS NATURALLY INFESTED WITH *Pythium* SPP.

P. arrhenomanes isolated	Oospores in root lesions; no isolations attempted
Agropyron cristatum (L.) Beauv.	**Agropyron Smithii* Rydb.
A. repens (L.) Beauv.	*Agrostis alba* L.
**A. pauciflorum* Hitchc.	**Elymus canadensis* L.
Avena fatua L.	*Festuca elator* L.
Bromus inermis Leyss.	**Hordeum jubatum* L.
**Phalaris arundinacea* L.	**Lolium rigidum* Gaud.
Phleum pratense L.	*Panicum miliaceum* L.
Setaria viridis (L.) Beauv.	*Poa compressa* L.
Sorghum sp.	*P. pratensis* L.
	Setaria italica L. Beauv. (Hungarian and Siberian vars.)
Not attacked in two experiments:	
Bromus japonicus Thumb.	*S. lutescens* (Weigl.) Stuntz
Festuca rubra L.	**Stipa comata* Trin. and Rup.
**Hierochloë odorata* (L.) Wahl.	

* Native.

No dicotyledonous plants have been found attacked in the field or in the greenhouse by the species of *Pythium* pathogenic to wheat. They may be used in rotations with safety, if otherwise desirable.

MODIFICATIONS OF THE SOIL ENVIRONMENT

1. *The Influence of Commercial Fertilizers on Wheat in Browning Soil*

Because of the practical impossibility of completely eliminating the sources of infection from the soil, the best means of overcoming the root rot is to improve soil conditions which might lead to the development of more vigorous seedlings (27). Soil in diseased areas at the time of appearance of the disease is usually much lower in available phosphorus and somewhat higher in nitrate than soil in normal areas (25). One way of helping to improve seedling vigour is by the application of phosphatic fertilizers which, by increasing the number and rate of growth of the roots, enable the plants to escape the attacks of the root-infecting fungi and thus to have a greater part of their root systems functioning in a healthy manner. Experiments failed to show that the phosphatic materials increased the resistance of the root tissue appreciably.

Once the phosphate deficiency is removed, further nitrogen applications give significantly greater increases in growth than phosphate alone. But individual dosages of nitrogenous materials usually have little or no effect on the diseases, and may even be slightly harmful under conditions of phosphate deficiency.

The highly beneficial effects of ammonium phosphate (11-48) on the growth of wheat in field soil naturally infested with *Pythium* spp: is well demonstrated in Figure 2, the data for which are given in Table 2.

FIGURE 2. Wheat plants grown in field soil naturally infested with *Pythium*, the only difference being that the pot on the left received half a gramme of ammonium phosphate (11-48) at the time of seeding.

The fertilizer has considerably enhanced the development of the finer lateral roots as will be seen in the figure, while the increase in crown-root development and the reduction in the disease are shown in the table. The fertilizer has practically eliminated above-ground browning symptoms. Similar improvements from phosphatic materials are commonly observed under field conditions.

TABLE 2.—RESPONSE OF WHEAT TO AMMONIUM PHOSPHATE IN NATURALLY INFESTED FIELD SOIL. FEBRUARY 9 TO MARCH 17, 1937.

Treatment	Height	Crown roots			Plant weight	
		Total	No. healthy	Diseased	Dry tops	Increase
	cm.			%	gm.	%
None—control (infested soil)	21	21	8	61.9	1.34	—
Ammonium phosphate (11-48) 0.5 gm. per pot	33	27	14	48.1	4.09	205.2

Phosphorus is the element considered to be in greatest deficiency in browning soils, nitrogen is next, while potassium is present in ample amounts. Calcium sulphate when applied singly in heavy amounts as ground gypsum, gave moderate increases, but in combination with triple superphosphate much higher increases were obtained than with either component alone (27). Heavy dosages of ground sulphur also gave moderate increases. As much greater increases can be obtained from a small application of ammonium phosphate say, than from heavy applications of gypsum and sulphur, the commercial use of these latter compounds is not to be considered at present. Typical browning soils were not found to be sufficiently lacking in the trace elements, boron, copper, manganese or zinc, to warrant their use.

Studies, not yet completed, on the effect of triple superphosphate on the initiation of crown root development, indicate that there is no significant difference in the date of first appearance of crown roots between treated and untreated plants, but that subsequent growth in length is substantially increased by the phosphate during the first few days.

2. *The Influence of Triple Superphosphate on Non-cereal Crops in Browning Soil*

Alfalfa, buckwheat, carrots, flax, lettuce and sweet clover produced relatively poor growth in browning soil, but high increases were obtained when triple superphosphate was added (27). The roots of these non-cereal plants were healthy, so that the poor growth produced in browning soil appears to be due to phosphate deficiency. With cereals, however, the stunted growth and leaf discoloration of plants in browning root rot soil are always associated with *Pythium* root rot lesions from which strongly pathogenic *Pythium* spp. are commonly isolated. Furthermore, the disease is rarely found to any extent in the stubble crop on land which bore a diseased fallow crop the previous year, thereby indicating that the trouble is not one of nutrient deficiencies alone.

Unfortunately the rotation value of resistant crops is largely nullified by the fact that the parasites persist in the soil for many years and apparently cannot be completely starved out in the absence of congenial host plants. The beneficial value of alfalfa or sweet clover in rotations in those sections where rainfall is sufficient is, therefore, due primarily to their improvement in soil fertility and to the fresh organic matter which they add to the soil.

3. *The Influence of Organic Amendments on Wheat in Browning Soil*

Farm manure, ground cereal straw, sweet clover hay, or weed hay, when added to browning soil, increase the growth of wheat and inhibit the root rot by stimulating root development, so that a higher number of longer roots per plant function in a healthy manner, though the same percentage may be diseased (25, 27). The washed root systems of the treated series are, however, whiter in mass than those of the controls.

Farm manure is the only one of the organic materials which gives adequate control comparable to that obtained by the phosphatic materials. Its use is consequently recommended as one of the major control measures. The slight to moderate benefit derived from the other organic residues is probably due to the phosphate and other nutrients which they return to the soil, as well as to their stimulation of microbiological activities.

4. *Firm Seed Bed*

It is observed that browning root rot rarely is found on the strip about 2 rods wide around the headlands. This has been attributed partly to the more compact nature of the soil due to cultivation and seeding operations. Packing the land has tended generally to lessen the trouble. Under greenhouse conditions, consistent, though slight, benefit results from compacting browning soil. It is common knowledge that overworked and loose summerfallowed land favours the disease. Late ploughing of the summerfallow generally lessens the disease. This improvement may be due to the larger amount of active organic matter contained in the heavier weed growth and also to the reduced number of cultivations necessary thereafter. Harrowing and cultivating should be kept down to a minimum compatible with efficient weed control. Farmers should give attention to the correct time to cultivate with reference to moisture content, so as not to destroy the soil crumb or structure.

A loose and open seed bed is also known to encourage the other root diseases, namely, take-all and common root rot, and in Australia great importance is attached to a compacted soil in helping to control these two diseases (10, 16). Every effort should be made to obtain as firm a seed bed as possible. Such operations as sub-surface packing, shallow ploughing and shallow cultivations, which tend to keep the subsoil firm should be used if other conditions permit.

Many instances of too deep seeding have been observed, especially during the drier years, when farmers feared that there would be insufficient moisture for germination. Deep seeding weakens the seedlings, and fewer seminal (24) and fewer and shorter crown roots are produced (17), thus providing better opportunities for the disease to develop.

SEED SOURCE AND QUALITY

The beneficial effects derived from phosphatic applications to browning soil, suggested that similar results might possibly be achieved by the use of seed from phosphate-fertilized soil. This seed will be referred to as phosphated-seed. A large number of samples of such seed and control seed from unfertilized areas were obtained in different years from the Dominion Experimental Stations and other sources, and tested in various ways for germinability and seedling vigour. The paired samples were also grown in browning soil. Similar experiments were conducted with wheat of low (9 to 10%) and high (19 to 20%) protein content of the varieties Apex, Marquis, Renown, Reward, Thatcher. As the results from a large number of experiments gave no important differences which were helpful from the control standpoint, the conclusions only will be presented here.

The chief difference was in the seminal root system which showed a fairly consistent tendency for a larger average number of roots and longer roots per plant in the phosphated-seed over the seed from untreated areas, and in low protein seed over high protein seed. In the length of shoot, dry weight of tops, number of crown roots, browning root rot symptoms and final yield of grain, no regular differences were discernible. In two experiments it was found that actual total dry weight of tops was greater from low protein than from high protein seed, but one unit of high protein seed produced more dry weight than one unit of low protein seed up to the 3-weeks stage.

Germination tests on large, plump seed and small, plump seed within a sample showed that the large seed produced more and longer seminal roots than the small seed. The small seed emerged quicker than the large

These several experiments indicated that plumpness and maturity of the seed were generally more important in producing vigorous seedlings in browning root rot soil than protein content or phosphated seed. Geddes *et al.* (12) have shown that phosphated seed is not necessarily different in phosphorus content from seed from untreated plants, unless the untreated soil was low in available phosphorus. Tests have shown that untreated seed from browning areas low in available phosphorus is usually lower in P_2O_5 than phosphated seed.

Seed treatments, even with protective fungicides, have failed to reduce the root rot. This is to be expected, as the pathogenic fungi are not seed borne but are present in cultivated field soils, and attack the tips of the larger roots and the finer laterals at some distance from the seed. Of course, any seed treatment which decreases seedling vigour may indirectly increase root damage by *Pythium*. The same is true of too deep seeding, smudged kernels, and mechanically or otherwise injured seed.

VARIETAL RESISTANCE

As previously stated no varieties of wheat immune to the disease are known. It is relatively easy to detect and count the lesions on the main crown roots at the time above-ground symptoms are severest; but the amount of disease on the finer seminal root system cannot be determined quantitatively because small infested rootlets are either broken

off in harvesting or fail to show from visual examination whether, or to what extent, they are attacked. In the aggregate, however, these diseased rootlets contribute very materially to the total damage. In the wheat variety tests reported here the disease estimate is based on the percentage of diseased crown roots (Table 3).

TABLE 3.—PERCENTAGE OF DISEASED CROWN ROOTS OF WHEAT VARIETIES GROWN IN NATURALLY INFESTED FIELD SOIL. 1937.

Date	No. of pots	Apex	Marquis	Pentad	Renown	Reward	Thatcher
Feb.-Mar.	4	41.7	50.9	47.6	57.3	53.6	46.6
June-July	3	33.3	27.8	21.1	44.4	34.1	30.7
Sept.-Oct.	6	49.0	72.3	54.8	53.5	65.6	48.9
Sept.-Oct.	3	36.2	57.5	38.9	46.2	68.6	33.3
Mean		40.0	52.1	40.6	50.3	55.5	39.9

All experiments were conducted in 6-inch containers in naturally infested field soil. In the June-July experiment the containers were placed on wooden platforms outdoors, while the other experiments were conducted as usual in the greenhouse. The varied light conditions especially, prevailing in the different tests, are important in an experiment of this kind.

Of the common bread wheats Thatcher and Apex showed about equally less disease than Renown, Marquis and Reward which followed in increasing susceptibility in the order given. The slightly higher resistance of Thatcher and Apex than Marquis and Reward in the field has already been referred to. Thus the delay in maturity caused by browning (28) will be greatest in Marquis and Reward, varieties which are also susceptible to stem rust. This is an additional reason for growing rust-resistant wheat varieties in Saskatchewan. The uniformly high germination of Thatcher was striking in these experiments as well as in those of phosphated seed and seed of low and of high protein content. The relatively low percentage of disease on Pentad is interesting because of its usually high susceptibility to *Helminthosporium* and *Fusarium* foot rot. If this difference with Pentad is maintained in the field it might be due to the fact that in the *Helminthosporium-Fusarium* rot, both crown and roots are damaged, whereas *Pythium* attacks the roots almost wholly.

DISCUSSION AND CONCLUSIONS

The general farming practice over wide areas of the Western Canadian prairies consists of a grain and fallow system. This constant cropping of the land to cereals results in increased liability to browning or *Pythium* root rot on the wheat crop following fallow in the rotation, but not at all, or at most only slightly, on the stubble or second crop. The increased incidence to the root rot is, therefore, not due entirely to decreased fertility of the soil. Rands and Dopp (19) have intimated that there has been an increase in average virulence of strains of *Pythium arrhenomanes* in the sugarcane soils of the Southern States in the course of a few years. This may be true in certain localities on the prairies, but it seems more reasonable to attribute the increase in root rot over the wide wheat growing areas of the Prairie Provinces to a change in soil conditions which renders the wheat seedlings more liable to infection.

It should be emphasized that several species of *Pythium* are capable of causing the disease, but *P. arrhenomanes* and *P. tardicrescens* are the two most commonly isolated, sometimes one predominating in a given locality or year and sometimes the other. This appears to be in contrast to the *Pythium* root rots of sugarcane (4, 19) and of milo (7) in which a single species is credited with causing most of the damage.

The root-infecting species of *Pythium* are indigenous and widely distributed in prairie soils, but even were they not, the ready dissemination of their resting spores during dust storms would probably ensure all soils becoming infested in the course of time. *Pythium* is known to be capable of persisting in the soil for many years in the presence of uncongenial crops or during years of fallow. It is believed that during this time they are in the oospore or resting stage, in which condition they are apparently not greatly affected by other soil organisms. It has, accordingly, not been possible to devise a practicable method of eradicating *Pythium* in the field as Garrett (11) has shown to be possible for the organism causing take-all root rot of wheat. Further, none of the common wheats is immune to the disease.

Control measures have, therefore, to centre on all operations which have as their objects an increase in seedling vigour and an inhibition of the active phase of the parasites. Advantage is also taken of any routine farm practice which inhibits or prevents the increase of the root-infecting fungi, such as, for example, the control of grass weeds which serve as congenial hosts.

The first step is to secure sound, plump seed preferably of a new rust resistant variety and without regard to protein or phosphorus content. Greaney *et al.* (14) have shown that the rust resistant varieties are more resistant to common root rot of wheat; the same is true for *Pythium* root rot. The increased liability to rust infection and possible further decrease in yield brought about by the delay in maturity which *Pythium* root rot causes, need not be of any concern if these newer varieties are used.

The grain system of farming draws heavily on the soil phosphorus, so it is not surprising that this element is generally in greatest deficiency in the black and brown soils of Western Canada. Furthermore, soil drifting has probably hastened this depletion since, as Pierre (18) has asserted, phosphorus is found chiefly in the finest soil particles.

Both chemical analyses and fertilizer experiments have shown that browning soils are usually deficient in phosphate for cereal and non-cereal crops. The disease is not restricted to any particular soil type, but neither is phosphate deficiency (18). The chemical findings, soil amendment results, and the virtual absence of the disease on the succeeding stubble crop, suggested the hypothesis that an unbalanced available phosphorus-nitrate relationship predisposed the wheat seedlings to attack by *Pythium* spp. (25). It was pointed out that the deficiency of available phosphorus was of major importance, and further that the beneficial effects of various amendments were apparently due to the development of more vigorous seedlings and possibly only secondarily to increased resistance of the roots to fungal invasion. Further work (27) has helped to clarify the situation to some extent. So long as the available phosphorus is deficient in infested

soil, nitrogenous applications are negligible and may be harmful; but with an ample supply of phosphorus, increasing increments of nitrogen increase plant growth substantially. Phosphorus is thus the chief limiting element, with nitrogen next in importance. Consequently it is not surprising that ammonium phosphate gives practical control of the disease in the fields.

Cereal straw ashes are moderately beneficial, as is the burning of straw in infested fields. This is considered to be due to the phosphate which the ashes contain and not to the destruction of the parasites in the stubble. As the writer (27) has already pointed out, similar improvement may be obtained by turning under the straw, and since this operation has other and more lasting effects, it is recommended in preference to burning.

The effect of the repeated grain and fallow system of farming is to deplete the prairie soils of carbon and nitrogen (Caldwell *et al.* 1), without much attempt being made to conserve or return these elements to the soils. It is possible that the organic matter in browning soils may be largely in an inert condition. This would help to explain the beneficial effects of fresh organic residues.

Farm manure by its beneficial effects on root development similar to those of phosphatic materials, gives practical control of the disease. Manure or other supplementary organic residues, when used in farm practice, should be applied to the soil before fallowing. Late ploughing of the summerfallow has been more beneficial than early ploughing in many instances. This may probably be due to the increased amount of organic matter turned under as weed growth, as well as to the reduction in the number of subsequent tillage operations on the fallowed land.

It is probable also that the organic amendments have an inhibitive effect on the active vegetative phase of the parasite because of increased activities of soil saprophytes antagonistic to *Pythium*. The slight reduction in the disease by compaction of the soil may be due to its inhibiting the spread of the mycelium through the soil.

Grasses may serve as congenial hosts for *Pythium*. This does not preclude their use in a rotation. From what little information is available on this point, it appears that the various benefits derived from the organic matter renewal of strongly rooting grasses such as brome and crested wheat more than offset the harmful effects of these grasses as hosts to the fungi. It is, however, best to avoid sowing wheat after pasture grasses, particularly after slender wheat grass (*Agropyron pauciflorum* Hitchc.). Flax is recommended, but if a grain crop must be sown, oats will probably do best. Grass weeds should, nevertheless, be completely controlled so as to reduce the parasitic fungi to a minimum.

In general, it appears from these studies that an increasing number of wheat soils on the prairies have reached a point where the liberation of phosphorus and other nutrients is inadequate for the plants' needs at a critical stage in their development. Under certain environmental conditions the plants fall an easy prey to the root-infecting species of *Pythium* present in such soils. The condition can be largely rectified by applying phosphatic fertilizers to the fallow crop, and by the regular additions of farm manure or organic residues, both of which increase nutrients and build

up biological activities. The problem of browning control resolves itself into correcting the depletions in soil fertility and the lack of nutrient balance brought about by the grain and fallow system of cropping, and of introducing into the present farming practice supplemental methods which will maintain the fertility in those soils where the root rot has not yet occurred.

SUMMARY

A review is given of the present knowledge of browning root rot of wheat in view of its recent increase in distribution and economic importance on the Canadian prairies. Special emphasis is given to those findings which serve as a basis for control measures. The disease may be caused by several species of *Pythium* of which *P. arrhenomanes* and *P. tardicrescens* are chiefly concerned.

It is pointed out that the general farming practice of a grain and fallow system of cropping has brought about a condition in which the wheat crop following fallow is becoming more liable to root infection from certain soil-inhabiting species of *Pythium* which cannot be eradicated. They may be spread to some extent by their oospores during dust storms. No immune varieties of wheat are known.

Practical control may be obtained by applying phosphatic fertilizers at the time of sowing or farm manure before fallowing. Nitrogenous fertilizers are of little or no value, and indeed may be slightly harmful, when applied singly to phosphate deficient soils, but once the phosphate deficiency has been rectified nitrogenous amendments will give further beneficial response. Partial alleviation of the trouble is obtained by ploughing under crop residues. Non-cereal crops are largely beneficial from this standpoint. At the same time the fundamental recommendations for cereal root diseases in general must not be neglected. These include the use of sound, clean seed of the most resistant varieties obtainable, early seeding in a firm seed bed, avoidance of deep seeding, and control of wild grasses.

Economic control depends largely on the development of vigorous seedlings capable of warding off the root-infecting fungi. The practices employed should centre on the production of strong, quickly growing plants. It is emphasized that results of lasting value can only be obtained by introducing into the present wasteful grain and fallow system, operations which will maintain the fertility of our better soils, and correct the depletions and lack of nutrient balance of those already infested with browning root rot. The recommendations are in accord with agronomic practices having as their objects the maintenance and improvement of soil fertility, and on these depend largely the future of our prairie agriculture.

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HOARY CRESSES IN CANADA[1]

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INTRODUCTION

The name hoary cress has been commonly applied in Canada to the plant known botanically as *Lepidium Draba* L. In the course of weed surveys in the Peace River region of northern Alberta, Canada, in the fall of 1939, attention was called to a suspicion that there might exist two types of hoary cress in that locality. Examination was made of some partly dried material which had been received at the Dominion Experimental Sub-station at Beaverlodge, and later of growing plants in a field near Grande Prairie. Under field conditions it was not difficult to distinguish patches, sometimes separate but often merging or mixed, of somewhat different appearance. Occurrence in mixture and the absence of any marked unevenness of ground or cultural conditions, excluded any probability of merely physiological variation. While in general character of root system, growth habit, foliage and inflorescence the two types appeared quite similar, possible specific distinction was suggested by the possession by one of narrower, more hoary leaves, smaller flowers and pods, and these pods hairy, firm and globular, instead of smooth and papery inflated as in the other. If difference in these respects had been met with before in hoary cress, it had not attracted attention. The likelihood of major weed pests so similar being found adventive together in this way seemed remote, but one such instance, reported from California, and actually involving hoary cress, was vaguely recalled, and later confirmed in detail.

Through the interest taken in the matter by District Agriculturists W. S. Scarth, W. H. Mead and T. S. Crack and Weed Supervisor J. L. Kerns, material was secured for study not only in the Grande Prairie, but also in the Berwyn and Rolla districts. In each of the latter more than one farm is known to have infestations, and east of Grande Prairie no less than thirty quarter sections are reported affected. In addition to these collections two specimens received for identification from near Grande Prairie in 1928 and 1929 were in the Division of Botany herbarium. Along with these were other specimens of hoary cress received at various times from other parts of Canada. Initial results of the examination of the material on hand were such that other herbaria were also drawn upon to secure a wider study of specimens. The results of the investigation are to be seen in citations to follow. As was also the case in California, not one but three obviously distinct plants have been shown to be passing as hoary cress.

In a paper by Bellue (1) in the California publication already referred to, the seed pod was held to provide the most useful characters for identification, and common names were assigned accordingly on the basis of pod shape. *Lepidium Draba* L. was designated heart-podded hoary cress; another, *Lepidium repens* (Schrenk) Boiss. was to be known as lens-podded

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hoary cress; and the third *Hymenophysa pubescens* C. A. Mey., as globe-podded hoary cress. It appeared from this paper that *L. repens* would be reduced by some to the status of a variety of *L. Draba*. It was further ascertained that Hitchcock (4) in his treatment of *L. Draba* reports an amount of intermediate variation which would, in his opinion, preclude delimitation of such a variety at all, although he cites a number of collections which are typical of what has been known as *L. repens*. He also points out the ease of confusing *H. pubescens* with *L. Draba* apart from shape and pubescence of fruits.

Since, as intimated, the three plants are all represented by Canadian material it is desirable that their characters should become known and that their distribution should be more fully traced. That they have been unwittingly confused does not argue that their differences in morphology and habit and consequently their several reactions to control measures, are of negligible account. While comparatively few Canadians have yet gained a first hand acquaintance with even one hoary cress, wherever any of these weeds are known they are recognized to be most persistent pests.

NOMENCLATURE

Before proceeding to further description, it is necessary to explain some departures from current nomenclature which are to be followed merely as arbitrary choices awaiting further taxonomic research. Rydberg's (8) adoption of Desvaux's (3) *Cardaria* as the generic appellation for the species *Draba* is a change which has the support of competent botanists both in Europe and America who are impressed by its unlikeness to other *Lepidiums*. The combination of *repens* with *Draba*, with varietal status, seems also warranted. For the benefit of his opinion thanks are due Mr. Reed C. Rollin (7) working at the Gray Herbarium, Harvard University, who, in a letter under date of Nov. 8, 1939, sums up a discussion of the matter thus: "Without having gone into the problem very deeply, I should suggest that *L. Draba* and *Hymenophysa pubescens* are congeneric and that they are not members of the genus *Lepidium*. Of course I don't know anything about the other Asiatic species of *Hymenophysa* but my inclination would be to maintain *Cardaria Draba* (O. E. Schulz has transferred *L. repens* to it as a variety) and unite *Hymenophysa* with it." Until such revision has been consummated it is perhaps sufficient to note the close relationship indicated for these three strikingly similar hoary cresses without for the present disturbing the status of *Hymenophysa*. It is of interest also that the three plants are indigenous in somewhat contiguous territory and may well occur together in parts of it as they do in California. *C. Draba* is understood to be a native of Eurasia, *C. Draba* var. *repens* of Afghanistan, and *H. pubescens* of the Altai Mountain region. Mr. Rollins writes further that occurrence together of these species was found commonly in Wyoming in 1932, and was pointed out to others at the time.

DESCRIPTION

For more complete descriptions than can be given here the reader is referred to such Old World works as Ledebour's Flora Altaica (5) and Flora Rossica (6) and Boissier's Flora Orientalis (2). Only the more useful field and laboratory points of difference and resemblance will be pointed out.

The rooting of the three plants is similar in its freely branching and creeping perennial character. They penetrate deeply, as excavation of *C. Draba* at Ottawa has shown. At four feet in gravelly clay soil, roots of some size were still left unexposed. They are capable of storing an abundance of food, and those near the surface sprout freely from numerous joints to extend the area covered. In California *C. Draba*, while earliest introduced, appears to be regarded as the least widespread and aggressive of the group.

Above ground a branching, often sprawling, rather than firmly erect habit, is common to all. Plants are commonly about a foot in height, spreading out above to form a diffuse racemose inflorescence. In *H. pubescens* this spread is often less pronounced owing to a less divergent angle of the flower pedicels from the branches. Leaves are borne alternately up to the inflorescence, clasping the stem with lobes at base, except the basal ones which are narrowed to a short petiole. They are variously but usually rather sparingly toothed, roughly elliptical in shape, and more or less hoary with a fine pubescence. The leaves of *H. pubescens* tend to be narrower, less luxuriant and often more hoary in appearance. The flowers are typically cruciform, white, and from one-eighth to one-quarter inch in diameter, those of *C. Draba* var. *repens* tending to exceed the others in size. The buds of *H. pubescens* are hairy and are often tinged with a faint rose colour, and later the fruiting spikes may develop a purplish hue. The pods, which afford the best means of identification, even long before maturity, must be noticed more particularly. The pods of *H. pubescens* are, first of all, hairy, those of the other plants devoid of hairiness; they are globose whereas the others are flattened, particularly those of *C. Draba*;

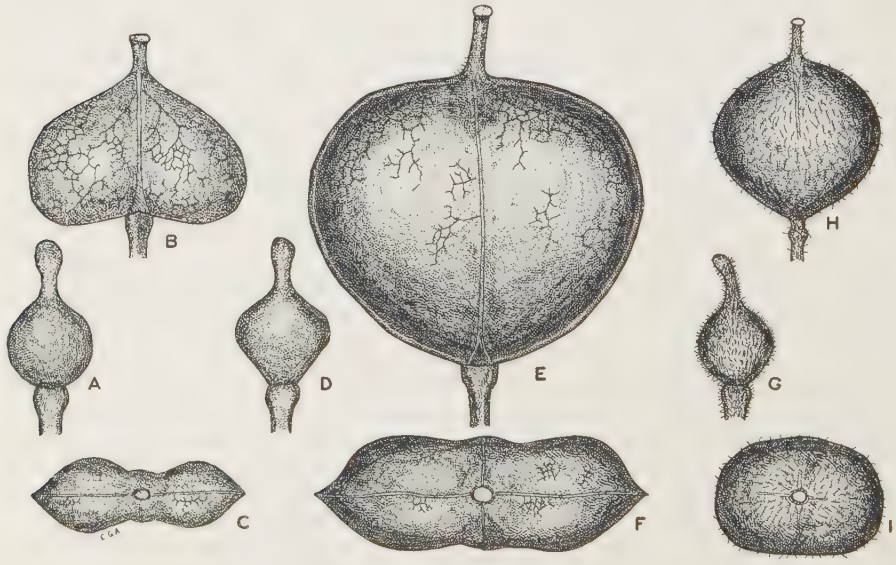

FIGURE 1. Fruits of three hoary cresses. *Cardaria Draba*. Heart-podded hoary cress. A, side view at fall of petals. B, side view at maturity. C, top view at maturity. *Cardaria Draba* var. *repens*. Lens-podded hoary cress. D, side view at fall of petals. E, side view at maturity. F, top view at maturity. *Hymenophysa pubescens*. Globe-podded hoary cress. G, side view at fall of petals. H, side view at maturity. I, top view at maturity.

they are inflated, which those of *C. Draba* are not, and those of its variety are, even more than those of *H. pubescens*; and they are, finally, smaller than those, at least, of *C. Draba* var. *repens*. Both *C. Draba* and its variety, particularly the former, are reticulated in age. Seeds are of little value for their separation unless examined side by side, when those of *H. pubescens* appear plumper. Those of *C. Draba* var. *repens* may average larger than the others.

According to Bellue, again, somewhat different seasonal habits are evident. *C. Draba* "was observed the earliest to form seed and complete blossoming", its variety *repens* "comes into blossom later than the true hoary cress and remains in bloom for a considerably longer period", while *H. pubescens*, starting to flower about the same time as the latter, "remains in bloom well into winter." At Grande Prairie there was evidence of the later persistence of blooming in what is now recognized as *H. pubescens*. At Ottawa *C. Draba* is in flower from late May until July, and begins maturing seed a month or so after coming into full bloom. A tendency to partial sterility, shown in the number of asymmetrical pods in some collections, has been independently observed by Mr. N. G. Lewis, Calgary Seed Laboratory, and also at Ottawa.

MATERIAL EXAMINED

In the light of the criteria available the specimens seen were distributed as shown in the citations following. Specimens were examined from the herbaria designated as follows:

Alta	University of Alberta, Edmonton, Alta.
AWA	Miss A. W. Anderson, Ottawa, Ont., private herbarium.
BCA	Provincial Department of Agriculture, Vancouver, B.C.
BCM	Provincial Museum of Natural History, Victoria, B.C.
Can	National Herbarium of Canada, Ottawa, Ont.
CSL	Seed Laboratory, Dominion Department of Agriculture, Calgary, Alta.
DAO	Division of Botany and Plant Pathology, Science Service, Department of Agriculture, Ottawa, Ont.
DAS	Division of Botany and Plant Pathology, Science Service, Department of Agriculture, Saskatoon, Sask.
OAC	Ontario Agricultural College, Guelph, Ont.
S	University of Saskatchewan, Saskatoon, Sask.
SC	Dominion Branch Experimental Station, Swift Current, Sask.
T	University of Toronto, Toronto, Ont.

1. *Cardaria Draba* (L.) Desv.

Common name: Heart-podded Hoary Cress.

Specimens examined:

Nova Scotia: Yarmouth, *B. Long & D. H. Linder 21282*, July 24, 1920 (Can), roadsides, waste places and ballast lands.

Quebec: Cap-a-L'Aigle, *J. Macoun*, July 14, 1905 (Can).

Ontario: Barrie, *J. Macoun*, Aug. 15, 1878 (Can), roadsides, escaped from gardens; Markdale, *T. S. Cooper*, June 25, 1926 (OAC), waste places; Walkerton, collector not stated, July 2, 1925 (OAC), waste places and cultivated ground; Galt, *W. Herriott*, July 10, 1901 (T), roadsides; River Speed, Guelph, *Bot. Dept.*, July 13, 1934 (OAC), waste

grounds; Niagara Falls, *W. Scott*, July 9, 1896 (Can), roadsides, June 10, 1899 (T); Chesterworth, *J. H. Spencer*, June 20, 1934 (OAC), waste places; Ottawa, *H. Groh*, June 6, 1930 (DAO, Can, Alta), vacant city lot, *E. G. Anderson*, 1934 (DAO), vacant city lot.

MANITOBA: Brandon, *J. Fletcher*, July 15, 1897 (DAO, S), on land, Aug. 1904 (DAO), comm. by *M. J. Tinline*, 1931 (DAO), *W. P. Fraser*, 1917 (DAS) *T. N. Willing*, June 12, 1909 (S).

SASKATCHEWAN: Indian Head, *David Macoun*, 1896 (DAO), stubble crop, *B. J. Sallans*, June 1, 1928 (DAS), *J. Reynolds*, no date (S).

BRITISH COLUMBIA: James Bay Flats, Victoria, *J. R. Anderson*, May 15, 1900 (BCM); Trail, *J. M. Macoun*, June 19, 1902 (Can); Armstrong, *C. Tice*, 1930 (DAO); Vernon, *W. B. Anderson*, May 14, 1929 (BCM).

2. *Cardaria Draba* (L.) Desv. var. *repens* (Schrenk) O. E. Schulz.
Common name: Lens-podded Hoary Cress.
Specimens examined:

SASKATCHEWAN: Traynor, *H. Groh*, June 24, 1932 (DAO), waste places; Landis, collector not stated, July 5, 1928 (S); Saskatoon, *W. P. Fraser*, July 1, 1932 (S), wheat field, *R. C. Russell*, June 20, 1933 (T), cultivated field.

ALBERTA: Grande Prairie, *Wesley Smith*, July 12, 1926 (Alta), *Joseph Davies*, Aug., 1929 (DAO), *H. Groh*, *W. S. Scarth* & *J. L. Kerns*, Sept. 11, 1939 (DAO), field left fallow; Carseland, *H. P. Hebbes*, July 30, 1935 (DAO); E. of Calgary 25 miles, *N. G. Lewis*, Aug., 1939 (CSL), prairie-cultivated.

BRITISH COLUMBIA: Vernon, *C. Tice*, July 25, 1935 (BCA); Cawston near Keremeos, *J. W. Eastham*, May 7, 1939 (DAO, BCM), associated with *Centaurea repens* L. in field and orchard; Summerland, *R. E. Fitzpatrick*, June, 1939 (BCA).

3. *Hymenophysa pubescens* C. A. Mey.
Common name: Globe-podded Hoary Cress.
Specimens examined:

SASKATCHEWAN: Swift Current, *Arch. C. Budd*, June 14, 1929 (DAO, SC), June 16, 1936 (S); Kelliher, *Fred Bruce*, June 26, 1933 (DAO); Scott, *Miss A. W. Anderson*, June 17, 1932 (AWA), *R. C. Russell*, June 20, 1934 (DAS); Sutherland, Kernan's Farm, *Miss A. W. Anderson*, June 23, 1938 (AWA).

ALBERTA: Teepee Creek (Grande Prairie), *Jack Head*, Aug., 1928 (DAO); Grande Prairie, *H. Groh*, *W. S. Scarth* & *J. L. Kerns*, Sept. 11, 1939 (DAO), field left fallow; Grimshaw, *H. Groh* & *W. H. Mead*, Sept. 11, 1939 (DAO), grain field; Carseland, *N. G. Lewis*, Aug., 1939 (CSL), prairie-cultivated; Chestermere Lake, E. of Calgary, *N. G. Lewis*, Aug., 1939 (CSL), prairie-cultivated.

BRITISH COLUMBIA: Rose Hill area, Kamloops, *C. Tice*, July 4, 1933 (D.A.O.); Pouce Coupe, *Sgt. Greenwood*, Aug., 1932 (BCM); Rolla (Miller Farm), *H. Groh* & *T. S. Crack*, Sept. 4, 1939 (DAO), field; Rolla (Tibbett farm), *H. Groh* & *T. S. Crack*, Sept. 4, 1939 (DAO), yards and garden; Cawston near Keremeos, *J. W. Eastham*, May 6, 1939, (DAO), associated with *Centaurea repens* L. in field and orchard; Salmon Lake, Nicola Dist., *T. H. Bond*, June, 1929 (BCM).

DISCUSSION

Examination of the citations discloses that the distribution of *C. Draba* is largely eastern, while that of the other species is entirely, according to present data, in the three provinces farthest west. The earliest record for *C. Draba* var. *repens* is 1926, and the earliest for *H. pubescens*, 1928, both being from Grande Prairie, where the first suspicion of their unlikeness has only now led to clarification of the situation, and publication of their occurrence in Canada. *C. Draba*, on the other hand, has been long known in Canada from both East and West. It had probably first some vogue as an ornamental plant, in view of Macoun's Barrie specimen collected in 1878 as "escaped from gardens." The use of its name for all three plants has resulted in a reputation for weediness which, while amply warranted, belongs even more truly to the western plants. Little notice has ever been taken of hoary cress in the East and its spread seems to have been slow, but for more than ten years past real concern has been shown over the progress of infestations in the West representing all the species.

One other outcome of this study, which is to be the subject of another paper, is the detection of a rather frequent association of the hoary cresses in the three westernmost provinces with Russian knapweed and certain other weeds of Russian origin. Russian knapweed has long been recognized as a characteristic impurity of Turkestan alfalfa seed; and the assumption is here made that the newer hoary cresses, at least, were introduced during the years when Turkestan alfalfa was admitted to Canada.

SUMMARY

Two weeds not previously reported in Canada, *Cardaria Draba* (L.) Desv. var. *repens* (Schrenk) O. E. Schulz and *Hymenophysa pubescens* C. A. Mey. were found to be growing together in the Grande Prairie, Alberta, region, and when identified proved to be both represented by considerable Canadian herbarium material which had been passing as *Cardaria (Lepidium) Draba* (L.) Desv.

Points of resemblance and difference between the three plants thus confused are presented, without however, going into taxonomic detail. The pods provide the best field characters for separation.

ACKNOWLEDGMENTS

To the custodians of the various collections seen, sincere thanks are extended for the privilege of studying their material. To officials already named, and to members of the staff of the Dominion Experimental Substation at Beaverlodge who first directed my attention to this subject the author is also grateful. For assistance from colleagues, especially Mr. E. G. Anderson and Dr. H. A. Senn, and for information from many others, indebtedness and thanks is expressed. Acknowledgment is gratefully made of the privilege accorded for so many years by the Dominion Botanist of keeping as a major project the slowly maturing Canadian Weed Survey.

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